

NERL/HEASD Publications

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Jan 1, 2002 - Dec 31, 2002

Presented Published

ABSTRACT/ORAL

Ozkaynak, H. Assessing children's exposures: issues, approaches and plans. Presented at: 2002 Annual Meeting of the International Life Sciences Institute (ILSI), Cancun, Mexico, January 19-24, 2002.

1/19/2002

Contact: Haluk A. Ozkaynak

Abstract: Estimation of exposures of children to pesticides requires careful consideration of sources and concentrations of chemicals that may be present in different environmental media and in foods and beverages consumed by children, as well as the different routes and pathways of exposures specific to daily activities of children of different ages. In order to understand better the processes that may contribute to higher exposures and risks to children from pesticides and other persistent pollutants, the National Exposure Research Laboratory (NERL) at U.S EPA's Office of Research and Development (ORD), began conducting a number of field studies. These studies have now collected substantial data on: indoor (residential and daycare) and outdoor pollutant and residue concentrations; personal exposures and biomarker levels in urine; dermal and ingestion transfer coefficients, and; young children's activities and behaviors that could influence their exposures to pesticides and toxic chemicals. In parallel with the measurement program, NERL has also developed a state-of-the-art probabilistic model (Stochastic Human Exposure and Dose Simulation Model, or SHEDS) that predicts the range and distribution of aggregate personal exposures and doses within a population as well as the uncertainty in the model estimates. The model framework has been developed with an initial case study for an organophosphate pesticide and the population of young children. The SHEDS model can simulate an individual's multimedia multipathway exposures up to a year time frame, accounting for multiple pesticide applications in the residential environment. Future versions of the SHEDS model will include more complete characterization of pesticide dose and metabolite concentrations in the body by coupling SHEDS to NERL's Exposure Related Dose Estimating Model (ERDEM). SHEDS and other models currently suffer from limitations of available input information on critical exposure factors for infants and young children, especially dermal and non-dietary transfer efficiencies or coefficients by activity type, location, surface and contact characteristics. In order to develop more robust models with more complete input data, repeated or longitudinal pesticide and other toxic chemical concentration measurements, time-activity data, and frequency of chemical product usage information in homes, day care centers and schools are also needed. Recently, a large-scale interagency program in the US, called the National Children's Health Study (NCS), has also been initiated to investigate the basic mechanisms of neurodevelopmental disorders and environmental factors that influence health and developmental processes of children. This study will identify about 100,000 children across the United States as early in the Mother's pregnancy as possible, then follow them through birth, childhood, and into adulthood. EPA will be responsible for designing the exposure assessment component of the study, likely to include measurement of indoor and outdoor concentrations, personal exposures and biomarker levels for a variety of pollutants, including combustion products and pesticides. This work has been funded wholly by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Luecken, D.J., and Tonnesen, G.S. Choosing a chemical mechanism for regulatory and research air quality modeling applications. Presented at: 7th US-German Workshop, Bad Breisig, Germany, October 9-11, 2002.

10/9/2002

Contact: Deborah J. Luecken

Abstract: There are numerous, different chemical mechanisms currently available for use in air quality models, and new mechanisms and versions of mechanisms are continually being developed. The development of Morphecule-type mechanisms will add a near-infinite number of additional mechanisms to this list. Choosing among these mechanisms is a difficult task. The chemical mechanism that you choose has a huge influence on the accuracy of the results as well as the computer resources required for the simulations. Thus, it is important that an appropriate mechanism be chosen for the type of simulation being performed, with a consideration of the species that you are interested in, as well as the temporal and spatial resolution required of the simulation. This talk will focus on the types and versions of chemical mechanisms available for 3-D air quality modeling studies of regional and urban gaseous air pollution, including updates to older mechanisms and Morpho-type mechanisms. We will summarize evaluations and intercomparisons of mechanisms, including specific chemical entities that must be compared in order to truly test mechanisms. Our recommendations for intercomparison of mechanisms utilize Process Analysis and Integrated Reaction techniques which allow the modelers to understand not only what the differences are among mechanism predictions, but why these differences occur. Model inconsistencies can be traced back to original radical formation and loss processes, and reactions with high uncertainties can be pinpointed for further study. We will discuss examples of in-depth comparisons of specific chemical mechanisms, research needs for evaluating new mechanisms, and the development of a protocol consisting of a recommended, standard set of tests that can be used to analyze the performance of a chemical mechanism and to compare two or more mechanisms. This work has been funded in part by the United States Environmental Protection Agency under PO 9D1000NAEX to the University of California, Riverside. It has been subjected to Agency review and approved for publication.

Wang, S.W., Vyas, V.M., Yang, Y.C., Georgopoulos, P.G., and Ozkaynak, H. Assessing multimedia/multipathway exposure to arsenic using a mechanistic source-to-dose modeling framework. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Haluk A. Ozkaynak

Abstract: A series of case studies is presented focusing on multimedia/multipathway population exposures to arsenic, employing the Population Based Modeling approach of the MENTOR (Modeling Environment for Total Risks) framework. This framework considers currently five exposure routes: inhalation, food intake, drinking water consumption, non-dietary ingestion, and dermal absorption. The simulation consists of the following steps: (1) Estimation of the multimedia background levels of environmental arsenic (air, water, and food) for the area where the population of interest resides through either environmental model predictions and/or measurement studies; (2) Estimation of multimedia levels (indoor air, drinking water, and food concentrations) and temporal profiles of environmental arsenic in various microenvironments such as residences, offices, restaurants, vehicles, etc. through microenvironmental mass-balance model simulations using the SHEDS (Stochastic Human Exposure and Dose Simulation) modeling methodology; (3) Selection of a fixed-size sample population in a way that it statistically reproduces essential demographics (age, gender, race, occupation, education) of the population unit used in the assessment (e.g., a sample of 500 people is typically used to represent the demographics of a given census tract); (4) Development of activity event sequences for each member of the sample population by matching his/her attributes to entries of USEPA's CHAD (Consolidated Human Activity Database); (5) Calculation of inhalation and intake rates for the members of the sample population, reflecting/combining the physiological attributes of the study subjects and the activities pursued during the individual exposure events; (6) Combination of inhalation, absorption and oral intake rates with the corresponding multimedia concentrations of the environmental arsenic for each activity event to assess exposures; (7) Estimation of target tissue doses (e.g., kidney, liver) through physiologically based pharmacokinetic (PBPK) modeling based on inhaled, dermal, and ingested doses of environmental arsenic for the members of the sample population. This work had been funded in part by the US Environmental Protection Agency under Cooperative Agreement # EPAR-827033 to Environmental and Occupational Health Sciences Institute. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Graham, S.E., Burke, J.M., and Ozkaynak, H. A probabilistic modeling framework for predicting population exposures to benzene. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Stephen E. Graham

Abstract: The US Environmental Protection Agency (EPA) is modifying their probabilistic Stochastic Human Exposure Dose Simulation (SHEDS) model to assess aggregate exposures to air toxics. Air toxics include urban Hazardous Air Pollutants (HAPS) such as benzene from mobile sources, particulate organic matter and metals from industrial point sources, and formaldehyde from indoor sources. However, in addition to these and other air emission sources, many of these HAPS have exposure pathways other than through inhalation. Therefore, a model needs to be developed that allows for prediction of the population distribution of exposure to air toxics through both single or multiple exposure pathways. As part of a preliminary case study, benzene was selected for investigation and initial model development. Data for exposure factors, ambient air concentrations, and other relevant concentrations were compiled from multiple sources, including EPA's Aerometric Information Retrieval System (AIRS) and Consolidated Human Activity Database (CHAD), as well as measurement data obtained in the literature. The selection of critical microenvironments, the use of mass balance equations or linear models in generating specific exposure concentrations such as in-vehicle or indoor air concentrations, and the development of other microenvironmental exposure concentration distributions were based on human activity patterns, data quality, and data availability. The results of this research serve as inputs to a newly constructed SHEDS-Air Toxics model to estimate population distributions of benzene exposure and absorbed dose. This work has been subjected to United States Environmental Protection Agency review and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Zartarian, V., Xue, J., Dang, W., Ozkaynak, H., Cook, N., Aviado, D., and Mostaghimi, S. Modeling aggregate exposure and dose of children to a wood treatment preservative from playsets and home decks. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Valerie G. Zartarian morrison

Abstract: Pressure- or non-pressure- treated lumber may pose a potential health hazard to children if the children contact certain chemicals in soils around leaching wood structures and/or in dislodgeable residues that may form on the wood surfaces of the structures. A physically-based, Monte Carlo probabilistic model (SHEDS: Stochastic Human Exposure and Dose Simulation model) has been applied to assess the exposure and dose of 1 to 6 year-old children to a wood treatment preservative from contact with playsets and home decks. Three exposure time periods were considered: short-term (one day to one month), intermediate-term (one month to six months), and lifetime (6 years over a 75 year lifetime). Dermal contact with and ingestion of the chemical in both soil and wood residues were considered for a population of children simulated using time-location-activity diaries from EPA's Consolidated Human Activity Database (CHAD). Model outputs for both warm weather and cold weather scenarios include graphical and tabular displays of individuals' route-specific and aggregate exposure and absorbed dose time profiles, route-specific and aggregate population distributions, contributions to population absorbed dose by exposure pathway, and a sensitivity analysis reporting model inputs contributing most to variability. The findings from this case study include: (1) predicted total absorbed doses from decks and playsets are similar in magnitude; (2) predicted total absorbed doses are greater in warm weather than in cold weather; and (3) ingestion of and dermal contact with wood residues contribute more to predicted dose than from contact and incidental ingestion of soil for all of the averaging times analyzed. Despite current data limitations and model assumptions, the case study provides insights to the relative importance of exposure routes and model inputs for the wood treatment exposure scenario for children. This work has been funded wholly by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Burke, J.M., Rea, A.W., Suggs, J.C., Williams, R.W., Xue, J., and Ozkaynak, H. Ambient particulate matter exposures: a comparison of SHEDS-PM exposure model predictions and estimates derived from measurements collected during NERL's RTP PM panel study. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Janet M. Burke

Abstract: The US EPA National Exposure Research Laboratory (NERL) is currently refining and evaluating a population exposure model for particulate matter (PM), called the Stochastic Human Exposure and Dose Simulation (SHEDS-PM) model. The SHEDS-PM model estimates the population distribution of PM exposures by randomly sampling from distributions of ambient PM concentrations and exposure factors to estimate the distribution of PM exposures in various microenvironments (e.g., indoors at home, in vehicles, outdoors, etc.). SHEDS-PM model output also includes estimated contributions of these microenvironments to predicted total PM exposure, as well as the contribution from both PM of ambient origin and indoor sources of PM in these microenvironments. An application of the SHEDS-PM model was implemented using measurement data from the NERL RTP PM Panel Study. The study included daily measurements of PM_{2.5} personal exposure, as well as indoor residential, outdoor residential and ambient (central site) PM_{2.5} concentrations, during a 7-day study period for each participant within each of the four seasons from June 2000 - May 2001. Daily measurements of ambient PM_{2.5} concentrations and residential air exchange rates, and human activity pattern data obtained from daily diaries for each participant were used as input to the model. Additional model inputs, such as demographic data and residential characteristics, were matched to the RTP PM Panel Study population. The distribution of daily average total PM_{2.5} exposures predicted by the SHEDS-PM model compared well with the measurements of personal PM_{2.5} exposures from the RTP PM Panel Study. The median total PM_{2.5} exposure (50th percentile) for the SHEDS-PM predictions was 21 $\mu\text{g}/\text{m}^3$ compared to 19 $\mu\text{g}/\text{m}^3$ for the personal PM_{2.5} exposure measurements. The median personal exposure to ambient PM_{2.5} predicted by the model was 9 $\mu\text{g}/\text{m}^3$ for the study population and ranged from 2 - 38 $\mu\text{g}/\text{m}^3$. Predicted ambient PM_{2.5} exposures were not a consistent fraction of the ambient central site PM_{2.5} concentrations for the simulated population. The median ratio of the predicted ambient PM_{2.5} exposure to ambient PM_{2.5} concentration was 0.6, with 95% of the simulated population having ratios between 0.3 and 0.8. The model results were compared to estimates of ambient PM_{2.5} exposures derived from analysis of 24-hr integrated and continuous personal PM_{2.5} measurement data collected during the study. This comparison was used to evaluate the SHEDS-PM model prediction of population exposures to ambient PM_{2.5} and indicated that the model results were generally consistent with the estimates derived from measurement data. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Swartz, E.C., Stockburger, L., and Vallero, D.A. Monitoring toxic organic gases and particles near the World Trade Center after September 11, 2001. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Erick C. Swartz

Abstract: The September 11, 2001 attack on the World Trade Center (WTC) resulted in an intense fire and the subsequent, complete collapse of the two main structures and adjacent buildings, as well as significant damage to many surrounding buildings within and around the WTC complex. This 16-acre area has become known as Ground Zero. In response to this disaster, the US EPA quickly positioned air monitors and samplers around Ground Zero to characterize the resulting air plumes. One such instrument was a High Capacity Integrated Organic Gas and Particle (HiC IOGAP) sampler with a 2.5 mm cyclone for particle discrimination to collect semi-volatile gases and particles for speciation of organic compounds. The results indicate that after the initial destruction of the WTC the remaining air plumes from the disaster site were comprised of many pollutants and classes and represent a complex mixture. This mixture includes compounds that are typically associated with fossil fuel emissions. The molecular markers for these emissions include the high levels of PAHs observed, the n-alkanes Carbon Prefix Index ~ 1 (odd carbon:even carbon ~ 1), as well as pristane and phytane as specific markers for fuel oil degradation. These results are not unexpected considering the large number of diesel generators and oversized vehicles used in the removal phases. The mixture also includes emissions of burning and remnant materials from the WTC site. The molecular markers for these emissions include retene and 1,4a-dimethyl-7-(methylethyl)-1,2,3,4,9,10,10a,4a-octahydrophenanthrene which are typically biogenic in origin. In addition, the compound 1,3-diphenyl propane [1?,1?-(1,3-propanediyl)bis-benzene] is found in significant concentrations. This species has not previously been reported from ambient sampling. It has been associated with polyvinyl chloride materials, which are believed to be in abundance at the WTC site. These emissions lasted for over three weeks (9/26/01-10/20/01) after the initial destruction of the WTC. This work has been wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Vyas, V.M., Wang, S.W., Sun, Q., Chandrasekar, A., Shade, P., Georgopoulos, P.G., Burke, J.M., and Ozkaynak, H. Advancements in source-to-dose analysis of population exposures to ozone. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Haluk A. Ozkaynak

Abstract: The current study takes advantage of the observations from regional air quality monitoring networks, the data from the NE-OPS (North East Oxidant and Particulate Study) Project in the Philadelphia region, and regional photochemical air quality model predictions to obtain and compare estimates of population exposure distributions for a two-week period in the summer of 1999. Field data were available from 32 ozone monitoring stations (including the NE-OPS station) within a radius of 100km from the urban Philadelphia NE-OPS (Baxter) site. The availability of both observations and modeling results for O₃, permitted the application of alternative spatiotemporal interpolation approaches in this study. Regional air quality predictions from runs of the USEPA Community Multiscale Air Quality (CMAQ) model, for the region and time period of interest, were used as alternative inputs to the population exposure model. The CMAQ runs were performed for the Eastern USA, for nested grids with higher resolution over the Philadelphia region. This study employed the consistent source-to-dose modeling framework of MENTOR-OPERAS/SHEDS (MENTOR-OPERAS: Modeling Environment for Total Risk studies/Ozone and Particles Exposure and Risk Analysis Systems; SHEDS: Stochastic Human Exposure and Dose Simulation). The region considered in the study encompassed the City of Philadelphia and a surrounding area. The study focused on a two-week episode, from July 11, 1999 to July 24, 1999. In order to link the modeling estimates of outdoor concentrations to population exposure models, the CMAQ results were used to calculate localized ambient ozone values for the 482 census tracts of urban Philadelphia. Two novel methods of spatiotemporal analysis were used and compared for obtaining the interpolated values at census tract level: the Spatiotemporal Random Field (STRF) method, and the Bayesian Maximum Entropy (BME) method. The STRF method uses a best linear unbiased estimate (BLUE) interpolation scheme that combines spatial and temporal information to provide more accurate estimates of interpolated concentrations than those resulting from purely spatial or purely temporal methods, thus reducing uncertainty associated with the estimates. The BME method uses sequential simulation techniques to combine hard and soft information on a random field to obtain the optimum posterior probability distribution (pdf) of the random process (the O₃ concentrations) over the spatial domain and temporal period considered. The localized outdoor concentration estimates were used as input to the combined MENTOR-OPERAS/SHEDS model, to obtain estimates of population exposures to ozone. The model combines demographic characteristics of the population with outdoor concentration distributions, outdoor-indoor air exchange rates, time-activity diaries, and indoor concentration distributions. It accounts for measurement uncertainty as well as natural variability in input parameters, and provides as output distributions of exposures and doses. The inhalation dosimetry module of this system uses equations that account for physiological and metabolic - as related to human activity - variability. Statistical tests and maps are used to compare and visualize the exposures and doses obtained using the alternative inputs for regional air quality concentrations (model predictions vs. monitor concentrations) and the localized estimates from different interpolation methods (STRF vs. BME). The results demonstrate the feasibility of developing population exposure assessments to ozone using a mechanistically consistent source-to-dose modeling framework. This work had been funded in part by the US Environmental Protection Agency under Cooperative Agreement # EPAR-827033 to Environmental and Occupation Health Sciences Institute. It has been subjected to Agency review and approved for publication.

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Presented Published

Edney, E.O., Speerand, R.E., Weathers, W.S., Kleindienst, T.E., Corse, E.W., and McIver, C.D. PM2.5 organic composition from several sites in the United States. Presented at: American Association for Aerosol Research, Charlotte, Nc, October 7-11, 2002.

10/7/2002

Contact: Edward O. Edney

Abstract: Organic constituents make up an important component of fine particulate matter (PM2.5) in ambient environments. While part of the composition of organic aerosol results from emissions of primary sources, an additional component appears to come from gas-to-particle conversion of photooxidation products of natural and anthropogenic hydrocarbons. These secondary products have been measured in simulated atmospheres in this and other laboratories. However, except under specialized circumstances, many of the oxidation products of anthropogenic origin are rarely reported in the fine particle fraction of ambient aerosols. A study was conducted to examine the summertime composition of PM2.5 at four locations along the Mid-Atlantic portion of the United States: a semi-rural field site in Research Triangle Park, North Carolina and urban sites in Baltimore, Maryland, Philadelphia, Pennsylvania, and New York, New York. Measurements were made for the inorganic and organic constituents of the fine particulate mass. Detailed analysis of the organic carbon was also undertaken using a double derivatization technique with PFBHA for the derivatization of carbonyl groups and BSTFA for hydroxyl groups. Inorganic ion (sulfate and nitrate) measurements, liquid water, and gravimetric measurements were also made from an aerosol collections on Teflon filters. Organic and elemental carbon were measured using a thermo-optical technique from aerosol collections onto quartz filters. The study was carried out over a three week period from 10 July - 02 August 2001. Samples for seven 24-hour and four 48-hour sampling periods were taken. Gravimetric results indicated that total mass loadings ranged from 5.7 to 42 $\mu\text{g m}^{-3}$ for the sampling periods during that time frame. At the rural site, the organic mass was estimated to comprise 57% of the total gravimetric mass. By contrast, at the urban site on average, the organic mass was estimated to comprise 32% of the total mass. The detailed analysis of the organic fraction from each of the urban sites showed chemical markers related to photooxidation products of aromatic hydrocarbons; oxygenated products from the rural site indicated the presence of biogenic precursors. In general, the aerosol was highly oxygenated and a wide range of substituted diacids appeared to be some of the dominant compounds found by this analysis approach. This work has been funded fully, or in part, by the United States Environmental Protection Agency, under Contract Number 68-D5-0049 to ManTech Environmental Technology, Inc. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Burke, J.M., Ito, K., Norris, G.A., Ozkaynak, H., and Wilson, W. Implications of selecting alternative exposure metrics in analyzing the relationships between PM and acute mortality and morbidity in Philadelphia. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Janet M. Burke

Abstract: The US EPA National Exposure Research Laboratory (NERL) has developed a population exposure model for particulate matter (PM), called the Stochastic Human Exposure and Dose Simulation (SHEDS-PM) model. The SHEDS-PM model estimates the population distribution of PM exposures by randomly sampling from distributions of ambient PM concentrations and exposure factors to estimate the distributions of daily-averaged total PM exposures. Daily-averaged total PM exposure for each simulated individual is determined from time-weighted PM concentrations for the various microenvironments (e.g., indoors at home, in vehicles, outdoors, etc.) the individual spent time in. Output from the SHEDS-PM model also includes the contributions to total PM exposure from PM of ambient origin and from indoor sources of PM. The SHEDS-PM model was applied to the population of Philadelphia, PA, using PM2.5 mass measurements collected daily at one site over a three year period (May 1992 to Sept. 1995). SHEDS-PM predicted total PM2.5 exposures, ambient-origin PM2.5 exposures, and non-ambient (indoor source) PM2.5 exposures were used in an epidemiological analysis and the results were compared with associations obtained using the daily ambient PM2.5 measurement data. Daily cardiovascular mortality, total mortality, cardiovascular hospital admissions, and respiratory hospital admissions were counted for the Philadelphia metropolitan statistical area (PMSA). A Poisson generalized additive model was used to regress the health outcomes on each of the SHEDS-PM predicted PM2.5 exposures (total, ambient-origin, and non-ambient), adjusting for seasonal cycles, day-of-week, major holidays, and weather effects. Distributed lags of 0 through 6 days for the SHEDS-PM predicted exposures were computed, and the sum of the coefficients and standard error (using variance/covariance matrix of lagged coefficients) were computed. The SHEDS-PM model predictions of ambient-origin PM2.5 exposures produced similar associations (magnitude and significance) with health effects to those obtained using the ambient PM2.5 measurement data. No significant relationships were observed for SHEDS-PM predictions of non-ambient PM2.5 exposures. However, associations with health effects for the total PM2.5 exposures predicted by SHEDS-PM varied depending on the demographic or housing covariates (e.g., data on residential HVAC system characteristics) selected or the distribution statistic used (e.g., average, median, 90th percentile) in the analyses. These results indicate that the SHEDS-PM model can provide alternative exposure metrics that are useful for enhancing the interpretation of epidemiological associations between PM2.5 and health effects. This work has been wholly funded by the United States Environmental Protection Agency under cooperative agreement number CR827358 to New York University School of Medicine. It has been subjected to Agency Review and approved for publication.

Burke, J.M., Vedantham, R., McCurdy, T.R., Xue, J., and Ozkaynak, H. A population exposure model for particulate matter: SHEDS-PM. Presented at: American Association of Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Janet M. Burke

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

Edney, E.O., Clegg, S.L., Bartolotti, L.J., and Kleindienst, T.E. Computational chemistry method for predicting vapor pressures and activity coefficients of polar organic oxygenates in PM2.5. 10/7/2002
Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

Contact: Edward O. Edney

Abstract: Parameterizations of interactions of polar multifunctional organic oxygenates in PM2.5 must be included in aerosol chemistry models for evaluating control strategies for reducing ambient concentrations of PM2.5 compounds. Vapor pressures and activity coefficients of these compounds, some of which are semivolatile, are needed to predict the ambient concentrations of oxygenated compounds that may be distributed across a number of phases within the aerosol and in the gas phase. However, few measurements have been made to date of thermodynamic properties of these compounds, rather model values have been estimated mainly using predictive methods including UNIFAC that are based upon correlations between the molecular structure and thermodynamics properties. While UNIFAC has been a reliable tool in chemical engineering, its use in aerosol chemistry has been somewhat limited because the data sets upon which the models have been trained have not included extensive data for multifunctional oxygenates. In the present study, the computational chemistry-based model COSMO-RS is employed to predict the vapor pressures and activity coefficients of multifunctional oxygenated compounds. COSMO-RS is a quantum chemistry-based continuum solvation model where the molecular descriptors are (1) the electronic energies of the solute molecule in the gas phase and in an infinite conductor and (2) the surface screening charge distributions of the solute and solvent molecules in an infinite conductor. Statistical mechanics is then employed to calculate vapor pressures and activity coefficients. The molecular descriptors are calculated using quantum chemistry methods, while the statistical mechanics component requires a number of parameters that must be obtained by fitting the model to experimental data. However, the number of fitted variables required by COSMO-RS is far fewer than those needed by UNIFAC. Because COSMO-RS is based on first principles to a larger extent than UNIFAC, one might expect that it would be more valid for compounds whose structures have not been included in the training set. The purpose of this study is to investigate this hypothesis. Density functional theory is employed to calculate values for the COSMO-RS molecular descriptors for a number of oxygenated compounds whose experimental data are available. These data are used to obtain the COSMO-RS fitting parameters. Vapor pressures and activity coefficients for multifunctional oxygenates detected in PM2.5 samples, calculated using COSMO-RS, are compared with available experimental data. This work has been funded fully, or in part, by the United States Environmental Protection Agency, under Contract Number 1D-5081-NANX to MCNC, Contract No. 68-D5-0049 to ManTech Environmental Technology, Inc and Contract 1D-5700-NATX to Dr. Simon L. Clegg. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Edney, E.O., Clegg, S.L., and Seinfeld, J.H. Thermodynamic modeling of liquid aerosols containing dissolved organics and electrolytes. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Edward O. Edney

Abstract: Many tropospheric aerosols contain large fractions of soluble organic material, believed to derive from the oxidation of precursors such as alpha-pinene. The chemical composition of aerosol organic matter is complex and not yet fully understood. The key properties of soluble inorganic aerosols - water uptake, deliquescence of the salts present, and equilibrium with gases such as NH₃ and HNO₃ - can readily be calculated using existing thermodynamic models. It is desirable to include soluble organic compounds and so treat internally mixed inorganic/organic aerosols. There are two main difficulties. First, the lack of fundamental thermodynamic data for organic compounds and their solutions in water. Second, a suitable theoretical approach must be found for aqueous inorganic/organic mixtures, applicable to systems of complex composition and high concentration (low relative humidity). A comprehensive model of soluble aerosols containing water, and both inorganic and organic components should also have the following properties. First, for the two limiting cases of an aqueous inorganic solution, and a mixture of organic compounds in water, it should yield results as accurate as existing models for the two different types of systems. Second, the effect on aerosol solution behaviour of the interaction of dissolved ions and organic molecules should be included in a flexible way. This allows varying levels of complexity, and therefore accuracy, in the way in which the interactions are represented. It is particularly necessary as few thermodynamic data are currently available for many aqueous inorganic/organic mixtures of relevance to aerosol chemistry, thus requiring initially very simple approaches. We have previously proposed a practical, thermodynamically self-consistent, method for predicting the properties of soluble mixed inorganic/organic aerosols (J. Aerosol Sci. 32 (6): 713-738, 2001). Here we describe an alternative approach which is likely to be particularly useful for systems for which thermodynamic data for ternary mixtures (i.e., salt-organic-water) are unavailable, and for high liquid phase concentrations. The new method is also likely to be computationally efficient, which is necessary for inclusion in atmospheric codes. The method is based upon an extension of the Zdanovskii-Stokes-Robinson relationship to include parameters for ternary (salt-salt-solvent, organic-organic-solvent, and salt-organic-solvent) interactions, combined with a well proven mixing rule for specifying the composition of multicomponent electrolyte mixture in terms of salts rather than ions. The extended ZSR relationship is used to calculate both solvent and solute activities. The equations are formulated in such a way that existing models for electrolyte-water and/or organic-water mixtures can be incorporated into the method without loss of thermodynamic consistency. Examples of the predicted deliquescence behaviour of salt-organic solutions, effects of salts on the vapour/liquid partitioning of organic compounds ("salting out"), and liquid/liquid phase separation will be discussed. This work has been funded fully, or in part, by the United States Environmental Protection Agency, under Contract 1D-5700-NATX to Dr. Simon L. Clegg. It has been subjected to Agency review and approved

Jan 1, 2002 - Dec 31, 2002

Presented Published

Edney, E.O., Speer, R.E., and Kleindienst, T.E. Assessment of the liquid water content of summertime aerosol in the Southeast United States. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Edward O. Edney

Abstract: The concentration of aerosol liquid water mass represents an important parameter for understanding the physical properties of PM_{2.5} in the atmosphere. Increases in ambient relative humidity can increase aerosol liquid water and thus the composite particle mass and particle volume, thereby increasing the light scattering properties of submicron particles that lead to degradations in visibility. Submicron aerosols have also been implicated in contributing to radiative forcing important in global climatic change. It has been recognized that presence of inorganic salts, in particular ammonium sulfate and other sulfate acids and salts, contributes to liquid water aerosol concentrations. Only very recently has attention turned to assessing the possible contributions of organic compounds to the liquid water concentrations. A field study was undertaken during the summer of 2000 to assess the impact of the presence of organic compounds on the liquid water concentrations of PM_{2.5} samples. The selected site, located in Research Triangle Park, North Carolina, was in a semi-rural environment with expected impacts from both biogenic and anthropogenic emissions. Eight samples, collected on Teflon filters over 48-h periods, were analyzed for their liquid water concentrations by using a beta gauge to measure the change in PM_{2.5} mass on the filter as a function of relative humidity in a humidity-controlled environmental chamber. The filter samples were also analyzed for mass, elemental and organic carbon, and inorganic ion concentrations. For six of the eight samples, the measured liquid water concentrations exceeded those predicted from the presence of the inorganic constituents. A relationship between the excess liquid water and the measured organic carbon mass was found but standard deviations associated with the measurements were large. Through modeling studies it was determined that about 80% of the liquid water in the PM_{2.5} could be accounted for by the inorganic ions present, with the remaining 20% associated with organic compounds. The liquid water data were consistent with the presence of aqueous solutions supersaturated with respect to the inorganic ions in the aerosol. This work has been funded fully, or in part, by the United States Environmental Protection Agency, under Contract Number 68-D5-0049 to ManTech Environmental Technology, Inc. It has been subjected to Agency review and approved for publication.

Swartz, E.C., Stockburger, L., McGaughy, E., McDonald-Buller, E., Allen, D., Michele, C., Lane, D.A., Pan, Y., and Gundel, L.A. Inter-site comparison of ambient aerosols in the Houston area during TEXAQS-2000. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Leonard Stockburger

Abstract: During the late summer of 2000 (8/15 - 9/15/00), the Texas Air Quality Study - 2000 (TEXAQS-2000) was conducted to improve understanding of the factors that control the formation and transport of air pollutants along the Gulf Coast of southeastern Texas. An international team of scientists used a variety of real-time and 24-hour averaged instruments to characterize ambient aerosols at three specific sites. The three sites (LaPorte, HMR3, Aldine) were chosen to characterize the nearby petrochemical refineries that line the shipping channel between Galveston Bay and central Houston. The main focus will be the inter-site comparison of over 60 non-polar semi-volatile organic species collected with a high capacity Integrated Organic Gas and Particle (HiC IOGAP) sampler. This is an abstract of a proposed presentation and does not necessarily reflect the United States Environmental Protection Agency (EPA) policy. The actual presentation has not been peer reviewed by EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Seila, R.L., and Lonneman, W.A. VOCs in ambient air near World Trade Center site. Presented at: 12th Conference of the International Society of Exposure Analysis, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Robert L. Seila

Abstract: Beginning on September 22, 2001 and continuing through February 2002, ambient air samples were collected at three sites within a block of ground zero and at a fourth site on the 16th floor of a building at 290 Broadway. Grab samples were collected in evacuated, electro-polished stainless steel canisters. The canisters were returned to Research Triangle Park for determination of C2 to C10+ volatile organic compounds by capillary GC-FID with cryogenic preconcentration. The limit of quantitation is less than 1 part-per-billion (ppb). Some samples were analyzed by GC-MSD. Of 193 samples collected 96 have been analyzed and qualified. In general concentrations were highest at the site north of ground zero followed by the southerly site and 290 Broadway. Some compounds showed a trend with maximum concentrations at the beginning of the study period followed by a decrease to background levels around mid-November. This behavior was displayed by the following compounds in order of decreasing abundance with maximum concentration indicated: ethylbenzene (44 ppb), benzene (26 ppb), propylene (21), toluene (16 ppb), xylenes (6 ppb), styrene (5 ppb), and naphthalene 1 ppb). All of these compounds are also present in vehicular emissions and gasoline. After November, when levels had returned to background, there was no significant concentration difference between the sites. Other compounds that are prominent in automobile exhaust and gasoline showed very little or no discernable trend. In this category, with maximum concentration indicated, were acetylene (59 ppb), n-pentane (28 ppb), isopentane (34 ppb), ethylene (32 ppb), benzaldehyde (7 ppb), and decane (3 ppb). Other abundant light hydrocarbons without a trend were ethane (59 ppb), propane (26 ppb), n-butane (24 ppb), and isobutane (18 ppb). This is an abstract of a proposed presentation and does not necessarily reflect the United States Environmental Protection Agency (EPA) policy. The actual presentation has not been peer reviewed by EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Dary, C.C., Knaak, J.B., Power, F.W., Thompson, C.B., and Blancato, J.N. Predictive organophosphorus (OP) pesticide QSARS and PBPK/PD models for risk assessment of susceptible sub-populations. Presented at: Society of Toxicology, Las Vegas, NV, September 26-27, 2002.

9/26/2002

Contact: Jerry N. Blancato

Abstract: Successful use of the Exposure Related Dose Estimating Model (ERDEM) in risk assessment of susceptible human sub-populations, e.g., infants and children, requires input of quality experimental data. In the clear absence of quality data, PBPK models can be developed and possibly enhanced through the judicious use of predictive Quantitative Structure Activity Relationships (QSAR). A thorough review of the available physicochemical and biological data revealed substantial data gaps and variances among experimental protocols. Published OP rat liver P450 microsomal Vmax, Km values on oxon formation were reviewed and compared with current studies with human liver microsomal P450 CYPs. Information on the inhibition of B-esterases (kis) by oxons, hydrolysis of the oxons (Vmax, Km) by plasma and liver A-esterases were reviewed along with conjugation reactions involving leaving groups. Deficiencies were evident for certain PBPK model parameters related to percutaneous absorption, i.e., Kp (cm/h), and tissue/blood partition coefficients and metabolic parameter such as Vmax and Km). From an understanding of the limitations of the available data, a predictive scenario-based PBPK/PD model was generated for 31 OP insecticides of interest to EPA from provisional QSAR estimates. New research is needed to obtain the necessary data for continued model construction and validation. This work has been funded (wholly) or (in part) by the United States Environmental Protection Agency under Interagency Assistance Agreement (DW 47944301) to GSA. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Robertson, G.L., Hern, S.C., and Rogers, K.R. Time-integrated exposure measures to improve the predictive power of exposure classification for epidemiologic studies. Presented at: National Children's Study Meeting, Baltimore, MD, December 17-18, 2002.

12/17/2002

Contact: Gary L. Robertson

Abstract: Accurate exposure classification tools are required to link exposure with health effects in epidemiological studies. Although long-term integrated exposure measurements are a critical component of exposure assessment, the ability to include these measurements into epidemiological studies is often limited by time, budget, and compliance issues. Another problem which arises when determining the sources, routes, and pathways of exposure to pesticides and other chemicals is the lag time between collection of a sample and the receipt of the results. Current methods which use laboratory analysis may take 30-60 days, or longer, to obtain results. This means that the source of exposure may be gone by the time it is discovered that the child has been exposed, given the relatively short half-lives of many compounds. Screening techniques could direct attention to the most highly exposed (to particular indicator compounds) population of children for which multiroute, multimedia monitoring would be of value. In addition, stratification of the study population (i.e., the majority of the environmental/biological samples collected from the "highly exposed population" of children) often is required, given the expense of multiroute, multimedia monitoring (numerous non-detect results are counterproductive in determining sources). This project will be conducted as four concurrent subprojects. Three subprojects will be directed at (1) demonstrating field performance of a semipermeable membrane device (SPMD) to collect long-term integrated samples for semivolatile organics in air, (2) developing simple rapid methods for analyzing the SPMDs, and (3) developing rapid field or near field methods for analyzing chemical metabolites in urine. The fourth subproject will be a literature review to identify available but not currently used techniques for long-term integrated exposure measurements. This work has been funded wholly or in part by the United States Environmental Protection Agency and this poster has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Egeghy, P.P., Quackenboss, J.J., Ozkaynak, H., and Ryan, P.B. Alternative exposure measurement designs to improve epidemiological study designs: determinants of temporal variability in environmental concentrations, exposures, and biomarkers. Presented at: National Children's Study Meetings, Baltimore, MD, December 17-18, 2002.

12/17/2002

Contact: Peter P. Egeghy

Abstract: The National Human Exposure Assessment Survey in Maryland (NHexas-MD) was a longitudinal study of multimedia exposure to metals, pesticides, and polycyclic aromatic compounds (PAHs). Measurements were made and questionnaires were concurrently administered to identify sources of exposure and to identify activities associated with elevated exposures. This project aims to identify significant determinants of the temporal variability identified in previous analyses and to examine the utility of available exposure assessment approaches in the context of this variability. Specifically, the relationship between relatively long-term estimates of exposures and time-varying explanatory factors related to the environment and to the study participants' activity patterns, diet, other personal attributes (as recorded in questionnaires and diaries) will be examined. The effectiveness of the various exposure assessment approaches, both individually and in combination, will be evaluated. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Quackenboss, J.J., Egeghy, P.P., Ozkaynak, H., and Thompson, C.B. Alternative exposure measurement designs to improve epidemiological study designs: use of human exposure study data to identify exposure questions for use in the NCS. Presented at: National Children's Study Meetings, Baltimore, MD, December 17-18, 2002.

12/17/2002

Contact: James J. Quackenboss

Abstract: The National Human Exposure Assessment Survey in Maryland (NHEXAS-MD) was a longitudinal study of multimedia exposure to metals, pesticides, and polycyclic aromatic compounds (PAHs). Measurements were made and questionnaires were concurrently administered to identify sources of exposure and to identify activities associated with elevated exposures. This project aims to identify significant determinants of the temporal variability identified in previous analyses and to examine the utility of available exposure assessment approaches in the context of this variability. Specifically, the relationship between relatively long-term estimates of exposures and time-varying explanatory factors related to the environment and to the study participants' activity patterns, diet, other personal attributes (as recorded in questionnaires and diaries) will be examined. The effectiveness of the various exposure assessment approaches, both individually and in combination, will be evaluated. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Whitaker, D.A., and Bradman, A. Exposures and health of farm worker children in California. Presented at: National Children's Study Meetings, Baltimore, MD, December 16-18, 2002.

12/16/2002

Contact: Donald A. Whitaker

Abstract: The EPA STAR Program Center of Excellence in Children's Environmental Health and Disease Prevention Research at the University of California at Berkeley is currently conducting exposure and health studies for children of farm workers in the Salinas Valley of California. The Exposure Measurement and Analysis Branch in the U.S. EPA National Exposure Research Laboratory has provided additional funding through the National Children's Study to monitor pesticide exposures of twenty children ages 6 to 24 months in their home environment. Samples collected include indoor and outdoor air, house dust, surface wipes, toy wipes, urine, duplicate diet foods, and leftover handled foods. Estimates of dermal exposures will be estimated from analysis of union suits and socks worn by the children. Time and activity data for the 24 hour monitoring period are collected for each participant. Questionnaires designed to obtain general information on environmental exposures as well as food related exposures are also administered. Results and lessons learned from this study will be used to develop questions, measurement methods, and models that can be used to cost effectively assess exposures to chemical agents for participants in the National Children's Study. This work has been funded in part by the U.S. Environmental Protection Agency under Grant # R826709B. It has been subjected to Agency review and approved for publication. Mention of trade names of commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Williams, R.W., Rea, A.W., Suggs, J.C., Leovic, K.W., Vette, A.F., Sheldon, L.S., Rhodes, C., Thornburg, J., Ejire, A., and Sanders, W., Jr. Exposure assessment from the NERL Research Triangle Park particulate matter panel study. Presented at: NCCU Environmental Seminar, Durham, NC, October 1, 2002.

10/1/2002

Contact: Ronald W. Williams

Abstract: The U.S. Environmental Protection Agency performed a particulate matter (PM) exposure assessment based on data from the National Exposure Research Laboratory (NERL) Research Triangle Park (RTP) Particulate Matter (PM) Panel Study. This study was a one-year investigation of PM and related co-pollutants involving two distinct subpopulations living within the RTP area of North Carolina. Primary goals were to characterize the relationships between ambient and residential PM measures to those obtained from personal exposure monitoring and estimate ambient source contributions to personal and indoor mass concentrations. A total of 35 participants were involved in personal PM_{2.5} exposure monitoring. Participating were 27 nonsmoking hypertensive African-Americans living in a low-moderate SES neighborhood (SE Raleigh, NC) and a multi-racial cohort of eight individuals having implanted cardiac defibrillators (Chapel Hill, NC). The volunteers were monitored for seven consecutive days during four consecutive seasonal periods (summer 2000, fall 2000, winter 2001, spring 2001). Results indicated that daily personal PM_{2.5} mass concentrations were typically higher than their associated residential or ambient measurements (e.g., hypertensive cohort mean personal = 27.6, indoor = 21.7, outdoor = 18.9, ambient = 18.9 ug/m³). Individual PM_{2.5} personal exposure concentrations were observed to range from 4 to 218 ug/m³ during the entire study period. Mean observed correlations between personal PM_{2.5} exposures and other ambient-based measurements varied significantly by season ($r = 0.3$ to 0.8). Factors influencing these variations are being investigated. Ambient PM_{2.5} mass concentrations were determined to be highly representative of those obtained from outside each residence regardless of season or distance ($r > 0.8$). PM_{2.5} personal cloud estimates for both cohorts averaged ~ 10 ug/m³ across the study. Mixed effects modeling indicates that ambient sources accounted for approximately 50% of the personal PM_{2.5} mass concentrations. Ranges of these estimates will be presented along with other summary findings. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Leovic, K.W., Williams, R.W., Ejire, A., Thornburg, J., and Rhodes, C.E. Recruiting and retaining African-Americans for an exposure study in Southeast Raleigh. Presented at: 2002 North Carolina Environmental Justice Summit, Durham, NC, October 18-19, 2002.

10/18/2002

Contact: Kelly W. Leovic

Abstract: The U.S. Environmental Protection Agency (EPA) recently completed a study of African-Americans' exposure to particulate matter (PM) in Southeast Raleigh. A primary goal was to compare PM levels measured at ambient and residential sites with those from personal exposure monitors. African-Americans were studied because there is little information on PM exposures among this community. Southeast Raleigh was selected from an environmental justice perspective because it is classified as a low to moderate socioeconomic status (SES) area. EPA collaborated with Shaw University, a historically black university located in Southeast Raleigh, on community outreach. Research Triangle Institute (RTI) performed field data collection. The study included 29 non-smoking African-Americans over the age of 50 who had controlled high blood pressure. The study took place over four consecutive seasons for 7-days each season. Participants wore personal monitors attached to a vest, had monitors placed indoors/outdoors at their residences, and completed a daily time-activity diary. Participants were compensated \$15/day, plus a \$20 bonus for 26+ days (max of \$440). To recruit participants, letters of support were requested from community organizations and leaders; the local media were informed; churches and community organizations (Wake County Human Services, Strengthening the Black Family, Triangle Family Services, Raleigh area NAACP) were contacted; and flyers were distributed in the community. Twenty-one of 29 participants completed at least three of four seasons. A key factor in retaining participants throughout the four-season study was their positive interaction with the researchers from RTI, Shaw, and EPA. Additional efforts to retain participants included continuing community outreach; providing framed certificates, personal letters, phone calls, and quarterly newsletters; holding quarterly participant meetings to promote "group camaraderie" and participant feedback; and providing study results quarterly based on participant input. Communication of results to participants was facilitated by asking the participants their preferred format for data presentation, avoiding technical language and jargon while maintaining scientific credibility, and providing results promptly. This work has been funded wholly by the EPA under assistance agreement #CR-828186-01-0 to Shaw University and contract 68-D-99-012 to Research Triangle Institute. It has been approved by the Agency for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Thomas, K.W., Sheldon, L.S., Sandler, D., Dosemeci, M., and Alavanja, M. Agricultural health study/pesticide exposure study: study design and preliminary biomarker results. Presented at: 2002 International State of Science Symposium on Agricultural Exposures and Cancer, Oxford, United Kingdom, November 19-22, 2002.

11/19/2002

Contact: Ellen W. Streib

Abstract: The Agricultural Health Study (AHS) is a collaborative effort between the National Cancer Institute, the National Institute of Environmental Health Sciences, and the U.S. Environmental Protection Agency to quantify cancer and non-cancer health risks in the agricultural community and to study the relationship between agricultural exposures and disease. The AHS is a large prospective cohort study being performed in the states of Iowa and North Carolina in the United States of America. Enrollment of 52,395 private pesticide applicators, 37,347 spouses of private applicators, and 4,916 commercial pesticide applicators was completed in December 1997. Pesticide applicators completed a study questionnaire that gathered demographic information, pesticide use information, crop and livestock information, application methods, use of personal protective equipment (PPE), and dietary and lifestyle information. Information derived from study questionnaires is used to classify applicator exposures to agricultural chemicals for subsequent investigation of associations between exposure and specific diseases. Algorithms have been developed for assigning applicator pesticide exposure intensity levels from questionnaire data. Exposure intensity scores are calculated using literature-derived scores for different application methods, uses of personal protective equipment, chemical handling, equipment repair, equipment washing, and personal hygiene. The U.S. EPA National Exposure Research Laboratory is conducting the AHS Pesticide Exposure Study (AHS/PES) to measure exposures resulting from the agricultural use of 2,4-D and chlorpyrifos for a subset of applicators in the AHS cohort. Measurement results will be used to assess questionnaire-based exposure classification algorithms. This work has been funded in part by the U.S. Environmental Protection Agency under Contracts 68-D99-011 and 68-D99-012, and through Interagency Agreement DW-75-93912801-0. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Tulve, N.S. NERL's quest to reduce uncertainties in children's health and risk assessments.
Presented at: Student Seminar for Brown Bag Lunch Series, Durham, NC, October 22, 2002.

10/22/2002

Contact: Nicolle S. Tulve

Abstract: Data on children's exposure to chemical contaminants and their activities are very limited. Quantitative assessments rely heavily on major default assumptions as substitutes for missing information (Cohen Hubal et al. 2000a, b). The goal of the EPA/NERL measurement research program in support of the Food Quality Protection Act (FQPA) is to develop and evaluate approaches and methods for assessing children's aggregate exposure to pesticides and to conduct studies to collect data required to reduce reliance on default assumptions in development of quantitative exposure assessments. Based on an initial assessment of critical exposure pathways and factors, researchers in the NERL identified four priority research areas where there are critical data gaps. These areas include: (1) pesticide use patterns, (2) spatial and temporal distribution of pesticides in residences and child care centers, (3) factors influencing dermal and non-dietary ingestion exposures, and, (4) dietary exposure. Collaborative efforts between the EPA/NERL and various research groups in other government organizations and academia have allowed us to conduct research to address these data gaps as follows: To reduce uncertainties in non-dietary ingestion exposure: Previously unpublished data collected by the Fred Hutchinson Cancer Research Center (FHCRC) were analyzed to assess the mouthing behavior of 72 children (37 male/35 female). Total mouthing behavior data included the daily frequency of both mouth and tongue contacts with hands, other body parts, surfaces, natural objects, and toys. Statistical analyses of the data were undertaken to determine if significant differences existed among the age/gender subgroups in the sample. Results indicated that there was no association between mouthing frequency and gender. However, a clear relationship was observed between mouthing frequency and age. To reduce uncertainties in dermal exposure: The Children's Post-Application Pesticide Pilot Study is a collaborative effort between the EPA/NERL and the Environmental and Occupational Health Sciences Institute (EOHSI) in New Jersey. Nine families with young children (<5 years old) were recruited to participate in the study. Homes were monitored for 28 days following a pesticide application. Four-hour videotape segments, time-activity diaries and questionnaires, cotton garments, and transferable residue loadings were collected during the study. Specific microenvironment and macroactivity combinations for these children were determined from the videotape segments and the time-activity diaries and questionnaires. Transferable residue loadings from the surfaces on which the children spent the majority of their time were measured using alcohol wipes. Cotton socks or pajama bottoms were used to calculate potential exposure to pesticide residues through the feet, knees, legs, and bottom. Transferable residues and cotton garment measurements were used to calculate transfer coefficients (TCs). To reduce uncertainties in multiple exposure pathways: The Duval County Health Department (Jacksonville, FL), in collaboration with the Centers for Disease Control and Prevention and the EPA/NERL, conducted a research study to characterize young children's potential exposures to organophosphate and pyrethroid pesticides. The overall objectives of this study were to: (1) measure the urine metabolite levels of organophosphate and pyrethroid pesticides from a group of 4-6 year old children living in the greater Jacksonville area, (2) identify possible household sources of these pesticides by performing screening measurements and pesticide inventories, (3) investigate whether the environmental pesticide levels correlate with the biological levels, and, (4) correlate questionnaire exposure information with the environmental data. Results of the pesticide inventory showed that synthetic pyrethroids were the primary pesticides used in the residences. An aggregate exposure assessment was performed for a subset of nine participants that included collection of environmental (surface wipes, transferable residues, indoor/outdoor air) and personal samples (a time-activity diary, pesticide residues on cotton socks, duplicate diet, urine) to evaluate potential exposure from each route (inhalation, dermal, dietary, indirect ingestion). To reduce uncertainties in pesticide use patterns in child care centers: The US Department of Housing and Urban Development, in collaboration with the Consumer Product Safety Commission and the EPA/NERL, conducted a research study to better understand the prevalence of pesticides, lead, and allergens in child care centers across the country. By participating in this study, EPA/NERL will obtain valuable information on pesticide usage in child care centers, concentrations of pesticides on surfaces in the centers that children may contact, and the distribution of pesticides within child care centers. Data on mouthing behavior and the transfer coefficients will be presented during this seminar. In addition, a discussion of the study design, data analysis plan, and preliminary data for the Jacksonville and child care center studies will be presented. These works have been funded wholly or in part by the United States Environmental Protection Agency under the following agreements: EPA Cooperative Agreement No. CR 816334-01 to the Fred Hutchinson Cancer Research Center; EPA Technical Services Contract No. 0D-5227-NAEX to the Environmental and Occupational Health Sciences Institute; EPA Technical Services Contract No. 1D-5377-NAGX to the Duval County Health Department; and EPA MOBIS Contract No. 23F-8144H to Westat, Inc. It has been subjected to Agency review and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Stevens, C. Overview of the Tampa asthmatic children's study. Presented at: West Central Florida Air Quality Coordinating Committee, Tampa, FL, October 18, 2002.

10/18/2002

Contact: Ellen W. Streib

Abstract: Asthma is the most common serious chronic disease of childhood and there has been an increase of about 50% in the prevalence of childhood asthma over the last 30 years. Ozone, particulate matter (PM), sulfur dioxide, nitrogen dioxide, and other combustion related products (CRPs), as well as air toxics have been identified as asthma triggers. The Tampa Asthmatic Children's Study (TACS) is a pilot study focused (a) on simple, cost effective methods for assessing environmental exposures relevant to asthma and (b) on techniques for the early assessment of asthma-related health outcomes. The methodologies developed from this research will be applied to a larger population in a future study, and will represent a vital building block for asthma research to be included in the proposed National Children's Study (NCS). The TACS design is to perform field monitoring using the simple cost effective data collection methods to identify and quantify exposure factors associated with CRPs, PM and air toxic pollutants in real-world environments, and to develop simple questionnaires, surveys and measurements for classifying exposure of asthmatic children living in the Tampa area. Special emphasis will be placed on collection of data relative to the proximity of the residences to CRP sources, housing type, household ventilation (penetration and deposition rates within the residence) and human activity profile factors. The cohort will consist of nine study participants who are 5 years of age and under, with diagnosed asthma or they may have a sibling that has been diagnosed with asthma. The participants will be from diverse incomes, races, and housing types. The participants' personal exposures, their residence (indoor and outdoor), and ambient concentrations of CRPs, PM, and select air toxics (e.g. aldehydes, ozone, etc.) will be monitored for four consecutive days during the data collection activities. Field data collection activities will begin in Tampa, Florida starting October 23, 2002 and ending November 12, 2002. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract # 68D-99-012 to the Research Triangle Institute. It has been subjected to agency review and approved for publication.

Sheldon, L.S., Cohen-Hubal, E.A., Tulve, N.S., Morgan, M.K., Stout, II, D.M., Melnyk, L.J., and Fortmann, R.C. EPA children's pesticide exposure measurement program. Presented at: 2002 International State of Science Symposium on Agricultural Exposures and Cancer, Oxford, United Kingdom, November 19-22, 2002.

11/19/2002

Contact: Linda S. Sheldon

Abstract: The U.S. EPA's National Exposure Research Laboratory conducts research in support of the Food Quality Protection Act (FQPA) of 1996. FQPA requires that children's risks to pesticide exposures be considered during the tolerance-setting process. FQPA requires exposure assessments to be conducted for all potential sources, routes and pathways, not just dietary intake. It also requires that exposure assessments use high quality and high quantity exposure data or models based on exposure factors generated from existing, reliable data. Currently, data on children's exposures and activities are very limited and insufficient to support quantitative assessments that do not rely heavily on major default assumptions as substitutes for missing information. Results derived from an initial assessment of critical exposure pathways and factors for assessing children's residential exposures to pesticides indicate that dermal exposure and nondietary ingestion may result in high exposures for children following residential applications. However, there are so few data associated with these pathways that exposure estimates may vary by orders of magnitude, depending upon the assumptions and exposure factors selected. Studies across all ages of children, but especially for very young children, are required to characterize activities that contribute to dermal exposure in important microenvironments. Studies are also needed to characterize contact and transfer factors for non-dietary ingestion. The goal of our program is to develop and evaluate protocols for assessing children's aggregate exposure to pesticides, and to conduct fields studies to collect data required to reduce the reliance on default assumptions in development of quantitative exposure assessments. To address this goal, studies are being conducted in the following areas: 1. Microenvironment/macroactivity patterns for children; 2. Pesticide use patterns; 3. Distribution of pesticide residues in nonoccupational microenvironments; 4. Exposure measurements using the microactivity assessment approach; 5. Exposure assessments using the macroactivity assessment approach; and 6. Field studies to verify assessment methods. A review and outputs of specific studies will be presented. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract nos. 68-D-99-011 to Battelle and 68-D-99-012 to Research Triangle Institute. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Thomas, K.W. Agricultural health study/pesticide exposure study: status update and preliminary results. Presented at: North Carolina Field Station Advisory Panel Meeting, Raleigh, NC, November 13, 2002.

11/13/2002

Contact: Ellen W. Streib

Abstract: The Agricultural Health Study (AHS) is a prospective epidemiological study of pesticide applicators and their spouses in Iowa and North Carolina. Exposure to 2,4-D or chlorpyrifos is being measured for a subset of applicators in the AHS Pesticide Exposure Study to assess exposure classification procedures. Applicators were selected based on specific application methods and use of personal protective equipment that would place them into one of eight exposure scenarios. Potential exposures are measured on one day of pesticide mixing, loading, and application (MLA) using dermal patch, hand wipe, and personal air samples. Urinary biomarker levels are measured in pre-and post-application samples from each applicator and from participating spouses and children. Questionnaires and observations of MLA activities provide information about work practices, use of protective equipment, and hygiene. A total of 108 field monitoring visits were performed in Iowa and North Carolina from 2000 through 2002. This included field monitoring visits to 24 North Carolina farmers. Although 112 North Carolina farmers consented to participate during 2001 and 2002, field monitoring visits were completed for only 24 farmers. In many cases farmers made decisions not to apply one of the target chemicals; this was particularly true in 2002 when drought conditions were cited as the reason that the target chemicals were not being used. North Carolina farmers were monitored in 7 of the 8 exposure scenarios. Applications to wheat, corn, tobacco, sweet potatoes, peanuts, soy, Bermuda Grass, hay, pasture, and fencerow weeds were monitored in North Carolina. Products containing 2,4-D were used in 17 of the monitored North Carolina applications (89 overall), products containing chlorpyrifos were used 6 times in North Carolina (18 overall). One North Carolina applicator made a last-moment decision not to use a 2,4-D product in combination with an atrazine product. His dermal patch, handwipe, and air samples were analyzed for atrazine but his urine samples were not analyzed. Urine samples were collected from 11 North Carolina spouses (48 overall). Urine samples were collected from three North Carolina children (12 overall). Preliminary urinary biomarker measurement results were examined for 71 applicator monitoring events completed in Iowa and North Carolina 2000 and 2001. Urine samples were collected from 35 spouses and 10 children during this period. For 59 monitored spray applications of products containing 2,4-D, the concentration in the applicators' first post-application urine sample ranged from 1.6 to 1040 ug/L. For 28 of the 29 spouses of these applicators the post-application urine 2,4-D concentrations ranged from < 1 to 14 ug/L; one spouse working with the applicator had a post-application concentration of 59 ug/L. Urinary 2,4-D concentrations for eight children ranged from 1.2 to 5.9 ug/L. For the 12 monitored applications of products containing chlorpyrifos (including three liquid spray applications and nine granular product applications) the concentration of the metabolite trichloropyridinol (TCP) in the applicators' first post-application urine samples ranged from 4.6 to 17 ug/L. TCP concentrations for chlorpyrifos applicator spouses (n=5) and children (n=2) ranged from 2.8 to 8.3 ug/L. The Spearman correlation between the pesticide applicators' second post-application urine samples and the spouses post application urine sample was 0.55 (p=0.0006, n=35); the correlation between the applicator and children was 0.22 (p=0.53, n=10). A preliminary examination in the differences in post-application urinary biomarker concentrations between the eight exposure scenarios was performed. Mean applicator urinary concentrations ranged from 9 +/- 5 ug/L (n=5) for a granular product application scenario, and up to 200 +/- 310 ug/L (n=18) for a hand-spray application scenario. Mean ratios of urinary concentration to the amount of active ingredient applied ranged from 0.3 +/- 0.1 (n=5) to 330 +/- 610 (n=18). The Spearman correlation between 71 applicator post-application urine concentrations and the AHS algorithm-derived exposure intensity scores for the eight exposure scenarios was 0.43 (p=0.0002). The Spearman correlation for the ratio of concentration to amount of active ingredient applied was 0.76 (p<0.0001). Preliminary results for North Carolina dermal patch, and handwipe, and air samples will be presented. Analyses of the data produced in the AHS/PES will continue as measurement results from the 2002 season become available. Dermal and air sampling data will allow more direct assessment of potential differences in exposures from specific, observed activities. These data will also be used to examine specific exposure pathways and specific work practices. Results from the AHS/PES will be used to assess how AHS exposure algorithms and questionnaires can be refined to improve exposure classification in the epidemiological study. Fact sheets summarizing the study results and conclusions will be prepared for distribution in agricultural communities of Iowa and North Carolina. This work has been funded in part by the U.S. Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names of commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Leovic, K.W., Williams, R.W., Ejire, A., Thornburg, J., and Rhodes, C.E. Recruiting and retaining participants for an exposure study in Southeast Raleigh. Presented at: 2002 North Carolina Environmental Justice Summit, Durham, NC, October 18, 2002.

10/18/2002

Contact: Kelly W. Leovic

Abstract: The U.S. Environmental Protection Agency (EPA) recently completed a study of African-Americans' exposure to particulate matter (PM) in Southeast Raleigh. A primary goal was to compare PM levels measured at ambient and residential sites with those from personal exposure monitors. African-Americans were studied because there is little information on PM exposures among this community. Southeast Raleigh was selected from an environmental justice perspective because it is classified as a low to moderate socioeconomic status (SES) area. EPA collaborated with Shaw University, a historically black university located in Southeast Raleigh, on community outreach. Research Triangle Institute (RTI) performed field data collection. The study included 29 non-smoking African-Americans over the age of 50 who had controlled high blood pressure. The study took place over four consecutive seasons for 7-days each season. Participants wore personal monitors attached to a vest, had monitors placed indoors/outdoors at their residences, and completed a daily time-activity diary. Participants were compensated \$15/day, plus a \$20 bonus for 26+ days (max of \$440).

To recruit participants, letters of support were requested from community organizations and leaders; the local media were informed; churches and community organizations (Wake County Human Services, Strengthening the Black Family, Triangle Family Services, Raleigh area NAACP) were contacted; and flyers were distributed in the community. Twenty-one of 29 participants completed at least three of four seasons. A key factor in retaining participants throughout the four-season study was their positive interaction with the researchers from RTI, Shaw, and EPA. Additional efforts to retain participants included continuing community outreach; providing framed certificates, personal letters, phone calls, and quarterly newsletters; holding quarterly participant meetings to promote "group camaraderie" and participant feedback; and providing study results quarterly based on participant input. Communication of results to participants was facilitated by asking the participants their preferred format for data presentation, avoiding technical language and jargon while maintaining scientific credibility, and providing results promptly. This work has been funded wholly by the EPA under assistance agreement #CR-828186-01-0 to Shaw University and contract 68-D-99-012 to Research Triangle Institute. It has been approved by the Agency for publication.

Fortmann, R. Demonstration of low cost, low burden exposure monitoring strategies. Presented at: National Children's Study Assembly Meeting, Baltimore, MD, December 17-18, 2002.

12/17/2002

Contact: Roy C. Fortmann

Abstract: This study is designed to develop and demonstrate relevant, low-cost, low-burden monitoring strategies that could be used in large longitudinal exposure/epidemiological studies, such as the National Children's Study. The focus of this study is on (1) recruiting and retaining participants (children and their caretakers) in a longitudinal exposure study and (2) demonstrating the feasibility of measurement strategies that use remote employment of readily available, easy to use, state-of-the-art methods, instruments, and/or techniques for assessing human exposures to environmental contaminants. The monitoring strategy involves mailing sampling kits to study participants with instructions for collecting biological samples (e.g., urine, breast milk, and hair) and environmental samples, such as water, house dust, surface wipes, and personal air samples (badges worn by participating children). After collection, participants package and ship the samples back to the laboratory. Participants also complete an on-line questionnaire that collects information on contaminant sources and participant activities at the time of sample collection. Results will be analyzed to determine participant compliance with sampling protocols, sample collection rates, survey response rates, participant retention rates, and information on how to reduce participant burden. The outputs from this study will be important in developing strategies and methods for measuring exposures to chemical agents during the National Children's Study. This work has been funded wholly or in part by the United States Environmental Protection Agency under Contract No.68-D-99-012 to Research Triangle Institute. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Alavanja, M., Sandler, D., Lynch, C., Knott, C., Lubin, J.H., Tarone, R., Thomas, K.W., Dosemeci, M., Barker, J., Hoppin, J.A., and Blair, A. Cancer incidence in the agricultural health study. Presented at: 2002 International State of Science Symposium on Agricultural Exposures and Cancer, Oxford, United Kingdom, November 19-22, 2002.

11/19/2002

Contact: Ellen W. Streib

Abstract: Despite low mortality and cancer incidence rates overall, farmers may experience excess risk of several cancers. These excesses have been observed in some, but not all, retrospective epidemiological studies of agricultural workers in several countries. Excess risk has been observed for cancers of the lymphatic and hematopoietic system, connective tissue, skin, brain, prostate, stomach and lips. Several of these tumors (brain, NHL, multiple myeloma, and prostate) are also increasing in the general population in many of these countries. This suggests that a common set of exposures may explain the higher rates in farmers and the rising rates in the general population. Farmers, their families, and other pest control workers may have contact with a variety of potentially hazardous substances including pesticides, solvents, fuels and oils, engine exhaust, dust and zoonotic viruses and other microbes. All of these exposures have potential health effects that need to be assessed. The multiplicity of these occupational exposures on the farm and the lifestyle of farm families (that is distinctive from the typical urban lifestyles) present both challenges and opportunities for the epidemiological assessment of cancer risk. Previous epidemiologic studies of farmers, other agricultural workers and pesticide applicators have been limited by inadequate exposure information. In some studies exposures were imputed from characteristics of the farm, the job, or the industry of the study subject. In other studies exposure information was collected from the study subject directly but only after the onset of the disease under investigation, possibly resulting in recall bias. The use of retrospective histories of lifetime exposures in case-control studies has been criticized because of the opportunity for exposure misclassification this could introduce, although in most cases would result in a bias toward the null. In most previous studies, regardless of the study design, the statistical power was limited. The Agricultural Health Study (AHS) was designed to mitigate previous design limitations by collecting detailed information about occupational and environmental pesticide exposures, lifestyle characteristics and personal and family health history prior to the onset of cancer in a large cohort (n=89,658) of licensed pesticide applicators and their spouses. The spouses of farmer applicators generally live near the fields where pesticide applications occur, and are, therefore, exposed to relatively high environmental (i.e., "by-stander") exposures. Many spouses also engage in farming activities including pesticide mixing and application. The occupational exposure information on individual pesticides collected in the AHS includes duration of use (years), frequency of use (applications days/year) and intensity of use (e.g., application methods, protective equipment, work practices). The information is updated every five years which will improve the accuracy of the data. The questionnaire data on pesticide exposure are validated with environmental and biological measurements of pesticides and metabolites as well as direct observation of selected cohort members. The study is conducted in two important agricultural states, that are representative of agricultural practices in a large portion of the United States (i.e., mid-west and southeast). Cancer incidence is ascertained by linking to the population based cancers registries in Iowa and North Carolina. Loss to follow-up for determining cancer incidence is minimized by the use of the National Death Index to ascertain vital status, and a variety of address registries which help identify the year a study participant moved out of the state of Iowa and North Carolina and are, therefore, no longer available for cancer incidence follow-up. This is the first report on the overall cancer incidence among the Agricultural Health Study cohort. Analytical investigations that evaluate individual exposures and cancers are the subject of separate reports. This work has been funded in part by the U.S. Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names of commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Vallero, D.A. Ethics and justice in environmental science and engineering. Presented at: Shaw University Visiting Scientists Program, Raleigh, NC, November 16, 2002.

11/16/2002

Contact: Kelly W. Leovic

Abstract: Science and engineering are built on trust. C.P. Snow's famous quote, "the only ethical principle which has made science possible is that the truth shall be told all the time" underscores the importance of honesty in science. Environmental scientists must do work that is useful to people. And, society trusts that what scientists and engineers do will perform "without fail." But we know that everything fails as a function of time and physical conditions. Numerous factors can influence the useful lifetime of what environmental scientists conceive and what engineers design. Characterizing environmental failures requires an understanding of the physical science, but also the roles of psychology, sociology, and the other social sciences in environmental outcomes. Environmental engineering case studies will be examined from the perspectives of various ethical decision making frameworks and, in particular, how both the social and physical sciences have influenced decisions leading to engineering successes and failures. The cases include the disaster response to the collapse of the World Trade Center towers and environmental justice. These cases hold other valuable lessons for the design professions, especially how engineers can improve risk assessment and risk communications, and how to present technical information in ways that are respectful of the diversity of how this information may be perceived (or misperceived) by various audiences. Of particular interest to the Shaw University Visiting Scientist Program, the cases will explore the value of academic integrity early in a student's life, and how early moral and ethical decisions may have consequences later in one's career. This work has been funded wholly by the U.S. EPA under assistance agreement #CT-828851-01 to Shaw University. It has been approved by the Agency for publication.

Vette, A.F., Landis, M.S., Williams, R.W., LaPosta, D., Kantz, M., Filippelli, J., Webb, L., Ellestad, T.G., and Vallero, D.A. Concentrations and speciation of PM at Ground Zero and Lower Manhattan following the collapse of the WTC. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Curtis M. Morris

Abstract:

Liu, S., and Pleil, J.D. Methods development and demonstration for assessing level of native pesticides, PCBs, PAHs, and VOCs in human blood. Presented at: American Chemical Society, Orlando, FL, April 7-11, 2002.

4/7/2002

Contact: Joachim D. Pleil

Abstract: Methods have been developed for screening and assessing the level of volatile, semi-volatile and non-volatile organic pollutants in human blood. The specific methodology is developed for measuring the presence of "native" compounds rather than their metabolites. Specifically, we chose a variety of organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), and aliphatic and aromatic hydrocarbons for investigation. This work is based on previously developed methods for semi-volatile hydrocarbon exposure from fuels usage and similarly employs liquid solvent extraction, evaporative volume reduction, and subsequent specialized gas chromatography - mass spectrometry analysis (GC-MS). The method is demonstrated for some commonly used pesticides on anonymous Red Cross blood specimens as well as for real-world blood samples from recent epidemiological studies of human subjects exposed to hydrocarbon based fuels. Details on recovery efficiencies, comparison on the level of selected persistent organic pollutants in blood among non-, pre- and post-exposures as well as correlations between blood and breath levels of some selected compounds are presented. The method provides access to data that is complementary to metabolic biomarker measurements that are typically made in the urine matrix, and also fills the data gap for circulating blood levels required to assess target organ dose through pharmacokinetic modeling. This is an abstract of a proposed presentation; it has been reviewed in accordance with the U.S. Environmental Protection Agency's review process and approved for publication. This work was funded by the National Exposure Research Laboratory, U.S. Environmental Protection Agency, through Contract 68-D-00-206 with ManTech Environmental Technology, Inc. Mention of tradenames or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Vette, A.F., Landis, M.S., Swartz, E.C., Williams, R.W., LaPosta, D., Kantz, M., Filippelli, J., Webb, L., Ellestad, T.G., and Vallero, D.A. Concentrations and composition of PM at Ground Zero and Lower Manhattan following the collapse of the WTC. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002. 10/7/2002

Contact: Curtis M. Morris

Abstract: The U.S. EPA National Exposure Research Laboratory (NERL), in conjunction with our Regional offices, established a network of air monitoring sites to characterize ambient air concentrations of gases and particles in lower Manhattan following the collapse of the World Trade Center (WTC). Monitoring at these sites was conducted on a daily basis from September 21, 2001 through April, 2002. Integrated 24-hour PM_{2.5} concentrations and continuous measurements of PM concentrations were made at three ground-level sites within 100-200 m of the WTC (Ground Zero). The Ground Zero sites triangulated the WTC to characterize both upwind and downwind concentrations. Another monitoring site was located about 500 m from Ground Zero on the 16th floor of a building at 290 Broadway. Measurements at this site included integrated 24-hour PM_{2.5} and PM₁₀ concentrations as well as continuous PM and black carbon concentrations. The integrated PM_{2.5} and PM₁₀ aerosols collected at these sites were analyzed for mass concentrations as well as elemental composition using X-ray fluorescence (XRF). In early October, 2001 two additional sites located about 500-1000 m from Ground Zero were equipped to measure airborne concentrations of 17 dioxin and furan congeners. Concentrations of PM_{2.5} surrounding Ground Zero were elevated and highly variable through late October, 2001. In general, concentrations of PM_{2.5} during this period were highest at the Ground Zero site located north of the WTC (96 \pm 85 mg/m³; mean \pm SD) and lowest at the southeast site (36 \pm 18 mg/m³). Concentrations of PM_{2.5} at the 290 Broadway site (25 \pm 22 mg/m³) were generally lower than those measured at Ground Zero through late October, 2001. Beginning in November, 2001, levels of PM_{2.5} decreased and were generally similar at the Ground Zero sites, but still somewhat higher than those measured at 290 Broadway. Dioxin and furan concentrations at a site located north of the WTC behaved similarly with elevated concentrations observed during October, 2001 that decreased and stabilized beginning in November, 2001. Analysis of the elemental composition of PM_{2.5} aerosols indicated elevated concentrations of crustal elements generally associated with building materials (e.g. Ca, S, Si, and K). In addition, elevated concentrations of Pb were observed initially as were elements normally associated with iron and steel (e.g. Fe, Cr, Ni and Mn). Typically, PM_{2.5} levels at 290 Broadway were similar to upwind concentrations measured at Ground Zero indicating the regional background contribution to PM_{2.5}. However, when downwind of the plume, PM_{2.5} levels measured at 290 Broadway were considerably higher, a possible indication that the site was being impacted by the WTC plume. For example, the maximum integrated 24-hour PM_{2.5} concentrations were measured at Ground Zero (403 mg/m³) and 290 Broadway (100 mg/m³) during one such plume event. The event occurred in the early morning and was characterized by a peak in the 10-min. PM concentration of 1000 mg/m³ and a black carbon concentration of 180 mg/m³. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-00-206 to Mantech Environmental. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Lewis, R.G., Stout, II, D.M., Fortune, C.R., and Ellenson, W.D. New application of passive sampling devices for assessment of respiratory exposure to pesticides in indoor air. Presented at: Pittcon 2002, New Orleans, LA, March 17-22, 2002.

3/17/2002

Contact: Curtis M. Morris

Abstract: The United States Environmental Protection Agency (EPA) has long maintained an interest in potential applications of passive sampling devices (PSDs) for estimating the concentrations of various pollutants in air. Typically PSDs were designed for the workplace monitoring of volatile organic compounds (VOCs) in ambient air. Their utility was found to be limited by interferences encountered during analysis and inadequate sensitivity. A thermally-desorbable diffusive sampling device with high sensitivity for VOCs was developed, but saw little use outside of EPA. Subsequently, the EPA and Harvard University modified the Ogawa 3300 diffusive sampler (originally designed for the collection of ozone) for the purpose of collecting organic compounds. Until recently, however, there has been little interest in the application of passive sampling for organic compounds in ambient and indoor air. Approaches for indoor residential air monitoring pose unique considerations associated with participant objections to sampling equipment noise, an increased potential of equipment tampering, and the lack of available space for the placement of sampling equipment. PSDs might present viable alternatives for estimating respiratory exposures inside occupied homes. Furthermore, unlike active samplers, PSDs may be deployed for days, weeks, or months to obtain integrated exposure estimates with little burden to the occupant. Of particular interest are indoor pollutants, such as pesticides, which fall into the semivolatile category (vapor pressures between 10^{-2} - 10^{-8} kPa at 25 C). Semivolatile pesticides are primarily present in indoor air as vapors and may be collected by diffusion onto a sorbent or by gas-sorbent partitioning. Based on these sampling principles, PSDs might be efficiently deployed in residential settings to sample a variety of indoor pollutants, determine estimates of respiratory exposures and to conduct screening levels surveys, while placing little burden on the occupants. Currently several different types of PSDs are undergoing evaluations by the EPA to determine their usefulness for the collection of pesticide vapors from indoor air. Included are traditional diffusion-controlled PSDs such as the EPA VOC device, the Ogawa 3300, and European radial diffusers. The EPA has also collaborated with the United States Geological Survey to help evaluate semipermeable membrane devices and with Midwest Research Institute to test a simple gas-sorbent partitioning sampler. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Huber, A.H. Visualization and simulation of toxic air pollutants released in urban areas-including homeland security applications. Presented at: Homeland Security Summit, Washington, DC, November 13, 2002.

11/13/2002

Contact: Alan H. Huber

Abstract:

Mukerjee, S. Recent applications of source apportionment methods and related needs. Presented at: Environment Seminar Series, St. Louis, MS, October 4, 1992.

10/4/2002

Contact: Shaibal Mukerjee

Abstract: Traditional receptor modeling studies have utilized factor analysis (like principal component analysis, PCA) and/or Chemical Mass Balance (CMB) to assess source influences. The limitations with these approaches is that PCA is qualitative and CMB requires the input of source profiles; both the interpretation of factors and which profiles to use in CMB can be fairly subjective. Ambient-based, multivariate receptor models, such as the EPA Unmix receptor model and Positive Matrix Factorization (PMF), have an advantage over profile-based models in that they not only estimate source contributions like CMB but also generate source profiles for source identification. In this presentation, a comparison of CMB and Unmix source contribution estimates will be presented using continuous measurements of volatile organic compounds (VOC) from an auto-GC. The VOC source estimates were then used to assess relationships to ultrafine particle number concentration data collected by a scanning mobility particle sizer and aerodynamic particle sizer at the same location. Recent EPA PM Panel Studies have used ambient-based receptor models like Unmix and PMF to evaluate indoor and outdoor influences based on ambient, indoor, and personal exposure measurements. While this area shows promise in identifying potential exposure factors, research needs also exist, particularly with regards to measurement methods development. The information in this document has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Kendall, M., Bonnanno, L., Wallace, L.A., and Lippmann, M. Indoor-outdoor PM_{2.5} and PM₁₀ in New York City. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: PM health effects have been reported to be highest in sensitive subpopulations such as COPD patients. Since such individuals spend higher proportions of their day indoors, the relationship between indoor and outdoor concentrations is therefore particularly important. The identification of the determinants of indoor concentrations - e.g., outdoor PM and indoor sources - is therefore also a priority for these individuals. In this study, the indoor-outdoor PM_{2.5} and PM₁₀ concentrations of eight COPD patient homes in NYC were monitored over two 12 day periods during winter and summer. Simultaneous measurements of indoor-outdoor PM_{2.5} and PM₁₀ concentrations were made at a central monitoring site (CMS) at 1st Ave. and 26th St. in Manhattan. Sampling locations were within a five mile radius of the CMS. Time-activity diaries were filled in by all study participants. The 24 hour mean indoor PM_{2.5} concentration was 27.8 $\mu\text{g m}^{-3}$ in summer and 20.1 $\mu\text{g m}^{-3}$ in winter for the group. PM_{2.5} concentrations were higher indoors compared to outdoors, and higher in summer than in winter. The mean PM_{2.5} indoor-outdoor ratio was 1.2 for winter and 1.5 for summer. PM_{2.5} indoor-outdoor ratios ranged between 0.9-1.4 for winter and 0.4-2.5 in summer. On average, the indoor PM_{2.5} concentration represented 77% and 76% of indoor PM₁₀ concentrations in winter and summer, respectively. PM_{2.5} concentrations indoor and outdoors were more closely correlated than the corresponding PM₁₀ indoor and outdoor measurements. Peak PM₁₀ concentrations also occurred indoors and during summer. Mean PM₁₀ indoor-outdoor ratios were 1.4 for winter and 1.8 during summer. PM₁₀ indoor-outdoor ratios ranged between 1.0-1.9 for winter and 1.0-3.4 in summer. PM₁₀ indoor-outdoor ratios were higher than PM_{2.5} indoor-outdoor ratios in both winter and summer. The relationship between the 24 hour mean PM_{2.5} and PM₁₀ concentrations over the 12 day sampling period varied between subjects. In some cases, PM_{2.5} was a good predictor of PM₁₀, a poor predictor in others. R² values of correlations between indoor and outdoor concentrations over time varied subject to subject, with an overall mean of $r^2 = 0.52$ for PM_{2.5} and $r^2 = 0.34$ for PM₁₀. The relationships between the indoor and outdoor concentrations were assumed to be a function of the home micro-environment, since a high correlation between PM_{2.5} tended to predict a good correlation between PM₁₀. Comparison of central and distributed sampling locations demonstrated good agreement between outdoor PM concentrations. PM_{2.5} concentrations (in and outdoor) were more correlated than the corresponding PM₁₀. However correlations between PM_{2.5} and PM₁₀ concentrations over the sampling period varied. On average, indoor PM_{2.5} accounted for approximately 80% of indoor PM₁₀ in both summer and winter. In general, PM_{2.5} concentrations were higher indoors than outdoors and higher in summer than winter. Maximum intra-PM sample type concentrations were consistently recorded in summer. Indoor-outdoor ratios of both PM_{2.5} and PM₁₀ were also higher in summer than in winter. This work was funded by EPA cooperative agreement #CR827164. This abstract has been reviewed by EPA and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Swartz, E.C., Stockburger, L., Vette, A.F., and Vallero, D.A. Polycyclic aromatic hydrocarbons (PAHs) and other semi-volatile organic compounds collected in New York City in response to the events of 9/11. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Daniel A. Vallero

Abstract: Concentrations of over 60 non-polar semi-volatile and non-volatile organic compounds were measured in Lower Manhattan, New York using a high capacity Integrated Organic Gas and Particle Sampler, after the initial destruction of the World Trade Center. The results indicate that the remaining air plumes from the disaster site were comprised of many pollutants and classes and represent a complex mixture of biogenic (wood-smoke) and anthropogenic sources. This mixture includes compounds that are typically associated with fossil fuel emissions and their combustion products. The molecular markers for these emissions include the high molecular weight PAHs, the n-alkanes, a Carbon Preference Index ~ 1 (odd carbon:even carbon ~ 1), as well as pristane and phytane as specific markers for fuel oil degradation. These results are not unexpected considering the large number of diesel generators and oversized vehicles used in the removal phases. The mixture also includes emissions of burning and remnant materials (e.g. carpets, furniture, wallboard and other flammable and aerosol-producing materials) from the WTC site. The molecular markers for these emissions include retene and 1,4a-dimethyl-7-(methylethyl)-1,2,3,4,9,10,10a,4a-octahydrophenanthrene which are typically biogenic in origin. In addition, the compound 1,3-diphenyl propane [1',1'-(1,3-propanediyl)bis-benzene] was observed and, to our knowledge, this species has not previously been reported from ambient sampling. It has been associated with polyvinyl chloride materials, which are believed to be in abundance at the WTC site. These emissions lasted for at least three weeks (9/26/01-10/20/01) after the initial destruction of the WTC. This is an abstract of a proposed presentation and does not necessarily reflect the United States Environmental Protection Agency (EPA) policy. The actual presentation has not been peer reviewed by EPA. Mention of trade names or commercial products does not constitute

Lyu, C., Wilson, N.K., Chuang, J.C., Satola, J., and Morgan, M.K. Recruitment and field sampling in the CTEPP North Carolina and Ohio field studies. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ellen W. Streib

Abstract: Recruiting study participants is always a challenge for researchers. It is more of a challenge when researchers have to recruit participants for a study involving intrusive, burdensome data collection activities. In this presentation, we describe our recruitment strategies and data collection methods in the research study, Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP) study. This study was conducted in North Carolina (NC) and Ohio (OH) to investigate the exposures of preschool age children and their primary adult caregivers to pollutants commonly found in their daily environments. Participants were recruited from daycare centers and from the general population using a random digit dialing (RDD) method. Field recruitment and data collection began in February 2000 in NC and was completed in November 2001 in OH. A total of 257 children (130 in NC and 127 in OH) and their adult caregivers participated. Participant exposure data were collected over a 48-hr period. Sample media include food, beverages, drinking water, urine, indoor and outdoor air, hand wipes, indoor floor dust, play area soil, dislodgeable pesticide residues, smooth floor wipes, and food preparation surface wipes. Personal interviews by field staff were conducted with the adult caregiver and the daycare staff to collect additional exposure information. Children's activities during the 48-hr period were recorded by the adult caregiver and daycare staff in provided activity diaries. In addition, about 10% (N=26) of the children were videotaped for about two hours at home to supplement the activity diaries. Strategies for enhancing the response rates were based on previous EPA pilot studies. These strategies included: a recruitment plan tailored for the specific target population (i.e., daycare centers, working parents, non-working parents), letters of endorsement from childcare associations and state licensing agencies, a certificate of confidentiality, an introductory letter and study brochure, use of FedEx for delivering introductory letters, multiple follow-ups (telephone and personal visit), participant training, non-monetary incentives, and monetary incentives. Innovative solutions were used to overcome field sampling problems such as using a doghouse to protect outdoor air sampling equipment, a playpen to protect indoor air sampling equipment, and having participant orientations. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract no. 68-D-99-011 to Battelle. The abstract has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Reid, C.M., Ryan, P.B., Wheeler, A., Wallace, L.A., and Suh, H.H. Associations between outdoor particulate (PM_{2.5}) concentrations and gaseous co-pollutant exposure levels for COPD and MI cohorts in Atlanta, GA. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: Epidemiological studies indicate that daily ambient particulate matter (PM_{2.5}) concentrations are associated with increased mortality, hospital admissions, and respiratory and cardiovascular effects. It is possible that the observed significant associations are the result of confounding by ozone, nitrogen dioxide, or sulfur dioxide, as ambient concentrations of these pollutants are often correlated with those of PM_{2.5}. This paper presents some of the results from an exposure and health conducted during fall 1999 and spring 2000 in metropolitan and suburban Atlanta, GA. In this study, repeated personal, indoor, and outdoor PM_{2.5}, PM₁₀, sulfate, carbon monoxide, elemental and organic carbon measurements were made, together with air exchange rate and cardiac health measurements for persons with chronic obstructive pulmonary disease (COPD) or who had a recent heart attack (MI). In the fall and spring, 24 and 22 individuals participated in the study, respectively. During each season, measurements were made for each participant over seven consecutive 24-hr periods using a multi-pollutant sampling device. This paper uses the PM_{2.5} and gaseous pollutant data to assess the potential for confounding of observed associations between PM and adverse health. Preliminary mixed modeling regression analyses indicate that personal PM_{2.5} levels were significantly associated with corresponding outdoor levels, as the slope of the regression line equaled 0.8 (s.e.=0.07, p<0.0001) in the fall and 0.27 (s.e.=0.09, p=0.004) in the spring. The regression of personal ozone levels on outdoor ozone levels yielded regression lines with small but statistically significant slopes, equaling 0.12 (s.e.=0.02, p<0.0001) and 0.08 (s.e.=0.02, p=0.0005) in the fall and spring respectively. In both seasons, outdoor PM_{2.5} and outdoor ozone have associations that are marginally significant at the 0.10 level. Personal PM_{2.5} levels were not significantly associated with personal or outdoor ozone levels in either season. This work has been funded by the United States Environmental Protection Agency under EPA Cooperative Agreement number (CR827159). It has been subjected to Agency review and approved for publication.

Cohen-Hubal, E.A., Suggs, J.C., Tulve, N.S., and Nishioka, M.G. Characterizing pesticide residue transfer efficiencies using fluorescent tracer imaging techniques. Presented at: American Industrial Hygiene Conference and Exhibition, San Diego, CA, June 1-6, 2002.

6/1/2002

Contact: Elaine A. Cohen-hubal

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

Kendall, M., Hsu, S.I., Lopez, P., Wallace, L.A., and Lippmann, M. Relating personal PM and PM-associated elemental carbon exposures to cardiovascular and pulmonary symptoms in a high-risk subpopulation. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: Sensitive subpopulations such as COPD patients have been shown to be especially susceptible to the effects of PM exposure. Proximity to traffic has been shown to be a predictor of PM effects in susceptible populations. Elemental carbon (EC) has been demonstrated to be a good indicator of combustion emissions, and in urban PM is a useful indicator of the diesel traffic contribution to PM concentrations. Extremely little personal EC exposure data exists, even though diesel exhaust exposure has been linked to cancer and the exacerbation and even onset of asthma. In this study, the personal exposures of COPD patients to PM10 and EC were monitored over 12 days during winter and summer. Simultaneous measurements of cardiovascular and pulmonary change indicators (pulse rate, blood oxygen content and lung function) were also made in order to relate particle concentrations with cardio-respiratory disease symptoms. A group of eight individuals were monitored during summer and winter sampling campaigns in 2000-2001. Personal exposures to PM10 and EC were measured using both personal sampling pumps to monitor 24 hour means on Teflon filters, and personal photometer (DataRAMs [pDRs], MIE Inc.) to identify short-term PM peaks. Co-located pDRs compared very favorably to central station TEOM monitors in identifying short-term peak concentrations. Teflon filters were subsequently analyzed using a light reflectance method (EEL reflectometer) to identify personal elemental carbon concentrations, following construction of a reflectance-absorption coefficient calibration curve. Time activity and symptom diaries were also filled in by all participants in order to identify micro-environments in which participants spent the majority of time, and to identify where peak PM concentrations coincided with specific activities or locations. Indoor and outdoor PM10 concentrations were also measured. Personal PM10 concentrations were higher than indoor micro-environmental PM10 concentrations. EC was a significant proportion of the personal PM samples. Filter and pDR sampler results were correlated, but correlations varied from subject-to-subject and depended on specific activities. pDR samplers identified specific peak exposures during the sampling periods, which, in some cases, could be related to specific activities. Relationships between PM concentrations and health indicators were complex and no clear pattern emerged within this group. This work was funded by EPA cooperative agreement #CR827164. This abstract has been reviewed by EPA and approved for publication.

Zhou, J., Jacob, D., Friedman, W., Fraser, A., Zeldin, D., Thorne, P., Cave, C., and Tulse, N.S. National surveys of multiple environmental hazards to young children in homes and child care centers. Presented at: American Industrial Hygiene Conference and Exhibition, San Diego, CA, June 1-6, 2002.

1/1/2002

Contact: Nicolle S. Tulve

Abstract: The Department of Housing and Urban Development (HUD) has teamed with other federal agencies to characterize exposure of multiple environmental hazards to young children in two main indoor environments, homes and daycare centers. Under the co-sponsorship of HUD and the National Institute of Environmental Health Sciences (NIEHS/NIH), the National Survey of Lead and Allergens in Housing (NSLAH) was conducted to assess children's potential household exposure to lead, indoor allergens, and endotoxins. Recently under the sponsorship of HUD, the Consumer Product Safety Commission (CPSC), and the Environmental Protection Agency (EPA), the First National Environmental Health Survey of Child Care Centers (CCC) has been carried out using a methodology similar to NSLAH's to evaluate lead, allergens, and pesticides in licensed daycare centers. The field work was completed in October, 2001. The two surveys complement each other, and will identify demographic, housing, and behavioral factors associated with high levels of exposure to these environmental hazards by children. This work has been funded in part by the United States Department of Housing and Urban Development under Contract No. C-OPC-21356 to Westat, Inc. This work has also been funded in part by the United States Environmental Protection Agency under MOBIS Contract No. 23F-8144H to Westat, Inc. It has been subjected to Agency review and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Tulve, N.S., Hore, P., Cohen-Hubal, E.A., and Sheldon, L.S. Use of the macroactivity approach to assess children's dermal exposure to pesticides in residential environments. Presented at: American Industrial Hygiene Conference and Exhibition, San Diego, CA, June 1-6, 2002.

6/1/2002

Contact: Nicolle S. Tulve

Abstract: In the macroactivity approach, dermal exposure is estimated using empirically-derived transfer coefficients (TC) to aggregate the mass transfer associated with a series of contacts with a contaminated medium. The macroactivity approach affords the possibility of developing screening level exposure assessments in a short time frame with few resources. However, this approach was developed to assess occupational exposure in an agricultural setting where workers are engaged in similar activities and are exposed to relatively homogeneous environmental concentrations of pesticides. The macroactivity approach needs to be tested in a residential environment with children. The Children's Post-Application Pesticide Pilot Study is a collaborative effort between the EPA and the Environmental and Occupational Health Sciences Institute (EOHSI) in New Jersey. Nine families with children (<5 years old) were recruited for this study. Homes were monitored for 28 days following a pesticide application. Four-hour videotape segments, time-activity diaries, cotton dosimeters, and transferable residue loadings were collected during the study. Activities and locations for children were determined from videotape segments and diaries. Transferable residue loadings were measured using a surface sampler (i.e., Lioy-Weisel-Wainman quantitative surface sampler or alcohol wipes). Cotton socks or pajama pants were used to calculate potential exposure to pesticide residues through the feet, knees, legs, and bottom. Transferable residues and cotton dosimeter measurements were used to calculate TCs. TC values for six children (one-active play, five-quiet play) were determined. TC values ranged from 4300-84000 cm²/hr (socks), 4000-28000 cm²/hr (legs), 41-3900 cm²/hr (knees), and 2100-7900 cm²/hr (bottom). TCs were found to depend on the activity level of the child, as well as the surfaces contacted. This work has been funded in part by the USEPA under Contract No. OD-5227-NAEX to EOHSI. It has been subjected to Agency review and approved for presentation and publication.

Fortmann, R.C., Sheldon, L.S., Cohen-Hubal, E.A., Morgan, M.K., Stout, II, D.M., Thomas, K.W., Tulve, N.S., and Whitaker, D.A. The EPA National Exposure Research Laboratory children's pesticide exposure measurement program. Presented at: Indoor Air 2002 The 9th International Conference on Indoor Air Quality and Climate, Monterey, CA, June 30-July 5, 2002.

6/30/2002

Contact: Ellen W. Streib

Abstract: The U.S. EPA's National Exposure Research Laboratory (NERL) conducts research in support of the Food Quality Protection Act (FQPA) of 1996. FQPA requires that children's risks to pesticide exposures be considered during the tolerance-setting process. The Act requires exposure assessments to be conducted for all potential sources, routes and pathways, not just dietary intake. It also requires that exposure assessments use high quality and high quantity exposure data or models based on exposure factors generated from reliable data. Data on children's exposures and activities are currently very limited and insufficient to support quantitative assessments that do not rely heavily on major default assumptions as substitutes for missing information. Studies are required for all ages of children, but especially for very young children, to characterize indoor pesticide sources, exposure pathways, the impact of children's activities on exposure, and children's aggregate exposures to pesticides by all routes and pathways. The goal of the NERL program is to develop and evaluate protocols for assessing children's aggregate exposure to pesticides, and to conduct fields studies to collect data required to reduce the reliance on default assumptions in development of quantitative exposure assessments. To address this goal, studies are being conducted in the following areas: o Spatial and temporal distribution of pesticide residues in indoor environments (residences, daycares, schools), o Pesticide use patterns indoors, o Dermal exposure measurements using microactivity and macroactivity assessment approaches, o Indirect ingestion exposure measurements, o Microenvironment/macroactivity patterns for children, o Protocol and methods development for aggregate exposure measurements, and o Field studies to verify assessment methods and collect exposure concentration and exposure factor data. This paper presents an overview of the NERL children's exposure measurement program, the goals, technical approach, descriptions of on-going and planned studies, and highlights of study results. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract nos. 68-D-99-011 to Battelle and 68-D-99-012 to Research Triangle Institute. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Stout, II, D.M., and Mason, M.A. The distribution of chlorpyrifos following a crack and crevice type applicaiton in the U.S. EPA indoor air quality (IAQ) test house. Presented at: Indoor Air 2002 The 9th International Conference on Indoor Air Quality and Climate, Monterey, CA, June 30-July 5, 2002.

6/30/2002

Contact: Daniel M. Stout

Abstract: Pesticides found in homes may result from indoor applications to control household pests or by translocation from outdoor sources. Pesticides disperse according to their physical properties and other factors such as human activity, residential air exchange, temperature and humidity. A study was conducted in the U.S. EPA Indoor Air Quality test house to determine the spatial and temporal distribution of chlorpyrifos following a professional crack and crevice application in the kitchen. Following the application, measurements were made in the kitchen, den and master bedroom over 21-days. Airborne concentrations were collected using both polyurethane foam (PUF) and a XAD/PUF media. Transferable chlorpyrifos residues were determined using a press sampler and C18 extraction discs. Spatial distributions, application surface loadings, and redeposition were measured using 10 cm² deposition coupons. Sections were cut from existing carpet to determine the total extractable residues. Surface wipes were and vacuum dislodgeable residues were collected in the kitchen and carpeted den, respectively. Measured airborne concentrations were similar for both samplers, detected in all rooms sampled, reached maximal concentrations 24-hours post-application and steadily declined by day 21. Concentrations measured from deposition coupons suggest that airborne residues sorbed to deposition coupons in all rooms sampled. However, carpet sections, due to high background concentrations of chlorpyrifos, poorly resolve the contribution of the application to carpet residues. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Vette, A.F., Rea, A.W., and Williams, R. Gaseous co-pollutants associated with particulate matter-results from the NERL RTP pm panel study. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: The U.S. EPA National Exposure Research Laboratory (NERL) conducted a longitudinal particulate matter (PM) panel study in Research Triangle Park, NC between June 2000 and June 2001. Participants were selected from two potentially susceptible sub-populations: a multi-racial group of cardiac patients in Chapel Hill, NC and a group of African-Americans with hypertension living in a low/moderate socio-economic status (SES) neighborhood in southeast Raleigh, NC. All 35 participants were over 50 years old, ambulatory, and non-smokers. Participants were sampled for 7 consecutive days during each of four sampling seasons. While the primary focus of the study was on PM exposures, personal, indoor, and ambient gaseous co-pollutants (CO, O₃ and NO₂) were also sampled. Integrated, 24-hr personal O₃ was measured using passive Ogawa badge samplers during the summer, fall, and spring seasons. Ozone was also measured continuously at a central ambient site using the TECO Model 49 analyzer during the summer, fall, winter and spring seasons. Integrated 24-hr NO₂ measurements were collected daily inside each participant's home as well as at the ambient monitoring station using Ogawa badges during all four seasons. Real-time CO (1 min avg. time) was measured daily inside each participant's home during all four seasons using the Drager 190 CO monitor. Real-time CO was also collected at the central ambient site using the TECO Model 48 analyzer during all four seasons. were highest during summer and lowest during winter. Ambient O₃ concentrations (mean \pm std. dev.) were 37.7 \pm 22.3 ppb during the summer, 28.9 \pm 16.1 ppb during spring, 17.9 \pm 15.9 ppb in the fall, and 13.7 \pm 10.4 ppb in the winter season. Peak ambient O₃ concentrations, however, were similar across all seasons. Personal O₃ exposures during summer (3.2 \pm 9.3 ppb) and spring (2.2 \pm 18.1 ppb) were very similar, but substantially lower than ambient O₃ concentrations. No significant differences in personal O₃ exposure were observed between cohorts. Data on personal O₃ exposures during the fall season were excluded due to high blanks. Overall mean indoor NO₂ concentrations were slightly higher in the Raleigh cohort (13.2 \pm 14.8 ppb) than the Chapel Hill cohort (7.3 \pm 4.4 ppb), likely due to the higher prevalence of gas stoves and furnaces in the Raleigh cohort. Seasonal differences were also observed with highest indoor NO₂ concentrations in the winter and lowest concentrations in the summer for both cohorts. Mean ambient NO₂ concentrations were as much as three times higher than mean indoor NO₂ concentrations. Ambient CO varied seasonally with fall (0.4 \pm 0.6 ppm) and winter (0.4 \pm 0.6 ppm) concentrations about two times higher than spring (0.2 \pm 0.3 ppm) and summer (0.2 \pm 0.2 ppm). Generally, there was little temporal variation in indoor CO for both cohorts except for periodic episodes of elevated concentrations. Peak CO concentrations were generally < 20 ppm for each cohort. Further analysis of these data will provide important information on the relationships between gaseous co-pollutants and PM_{2.5}. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Ambient O₃ concentrations

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Presented Published

Leovic, K.W., Sheldon, L.S., Thomas, K.W., Highsmith, V.R., Tolve, N.S., Robertson, G.L., Hammerstrom, K., Quackenboss, J.J., Melnyk, L.J., Berry, M., Pellizari, E., Lebowitz, M., and Ryan, P.B. Lessons learned from the National Human Exposure Assessment Survey (NHEXAS). Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Kelly W. Leovic

Abstract: Three NHEXAS Studies were conducted from 1995-1997 to evaluate total human exposure to multiple chemicals on community and regional scales. EPA established cooperative agreements with three Consortia to conduct three interrelated NHEXAS field studies. The University of Arizona, Battelle Memorial Institute, and the Illinois Institute of Technology studied several hundred Arizona residents. Several hundred participants from EPA Region 5 were studied by Research Triangle Institute and the Environmental and Occupational Health Sciences Institute. In a third study, Harvard University, Johns Hopkins University, Emory University, Southwest Research Institute, and Westat studied 80 Maryland residents. Interagency Agreements were established with the Centers for Disease Control and Prevention, the Food and Drug Administration, and the National Institute for Standards and Technology for biomarker and environmental analyses. Volunteer participants were randomly selected from each of three areas of the country to obtain a population-based probability sample. Scientists measured the levels of a suite of chemicals to which participants were potentially exposed in air, foods, beverages, soil, and dust. Measurements were made of chemicals or their metabolites in biological samples, including blood and urine. Participants completed questionnaires to help identify possible sources of exposure and to characterize themselves, their activity patterns, and the home environment. As a follow-up to the NHEXAS Studies, a Workshop was held in 2001 to: 1) document the experiences and lessons learned for use in designing and implementing future studies; 2) assess the feasibility of approaches for conducting NHEXAS-type studies and measurements on representative samples of the population and subpopulations; and 3) assess the adequacy of methods, approaches, and designs to collect data for multiple pathways/routes of exposures for multiple pollutant classes. Participants included individuals from the Consortia, EPA, and other federal agencies. Extensive interviews were conducted with participants before the Workshop to help serve as a basis for discussion. Highlights of lessons learned, as discussed at the Workshop, include: Large-scale population-based exposure studies can be planned, designed, coordinated, resourced, and logistically implemented. Relevant exposure samples and corresponding metadata can be collected to characterize aggregate exposures for key species for selected ages and lifestyles. The scientific community (federal agencies, universities, states, communities, contractors) can work together efficiently and effectively to plan and conduct studies. High percentages of samples can be successfully collected and analyzed for most media. Cooperative agreements can be appropriate funding mechanisms to support research. The extensive documentation developed and evaluated (e.g., Standard Operating Procedures, methods, databases) will be very useful for designing and conducting field studies. Results will be useful to develop future hypotheses and answer many current science issues. Lessons learned and areas for improvement in project leadership, study design, survey operations, field sampling, analytical laboratories, database issues, and quality assurance will be presented, along with recommendations for future studies. This work has been funded wholly by the U.S. EPA under contracts with University of Arizona (1D-5008NATX, 1D5010-NATX, 0D-5929-NATX), Battelle Memorial Institute (0D-5928-NANX), Research Triangle Institute (1D-5015-NANX), Environmental and Occupational Health Sciences Institute (0D-5925-NATX), Emory University (1D-5013-NAEX), Southwest Research Institute (0D5927-NANX), and Westat (1D-5012-NALX). It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Rea, A.W., Croghan, C., Thornburg, J., Rhodes, B., and Williams, R.W. PM concentrations associated with personal activities based on real-time personal nephelometry data from the NERL RTP PM panel study. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: A longitudinal particulate matter (PM) exposure study sponsored by EPA's National Exposure Research Laboratory (NERL) was conducted in the Research Triangle Park, NC area between June 2000 and June 2001. Participants were selected from two groups of potentially susceptible sub-populations: a group of African-Americans with hypertension living in a low/moderate socio-economic status (SES) neighborhood in southeast Raleigh, and a multi-racial group of cardiac patients with implanted cardiac defibrillators in Chapel Hill, NC. All of the participants were over 50 years old, ambulatory, and non-smokers. A total of 35 participants were sampled for 7 consecutive days during each of 4 sampling seasons (~28 days total for each participant). Detailed time activity information (15 min intervals) and continuous personal and indoor nephelometry (personal DataRAM, MIE Inc.) data were collected. The data from the nephelometers are interpreted semi-quantitatively in this analysis. The nephelometry data were averaged over 15 min consecutive time intervals and matched with the associated time activity diary. Individuals who had more than 10% of their PM mass associated with exposure to ETS (46 person-days) were removed from this analysis. Personal PM peaks elevated above ambient levels were identified in the nephelometry data and matched with the activities as described by participants on their time activity diaries or personal recall. For participants that slept at continuously night or did not have any elevated nighttime PM exposures, the average of the nighttime PM concentration was used as a baseline PM exposure (n=798 person-days). People with elevated PM concentrations due to nighttime activities were removed from the database (n=19 person-days). Peaks were identified during daytime activities and the baseline PM exposure was subtracted from this value for each individual on each day. Our preliminary analysis has identified 370 peaks. Results indicate that mean personal concentrations due to cooking were 291 plus/minus 614 ug/m3 (n=178; range 1 - 5580 ug/m3) while mean cleaning concentrations were 274 plus/minus 1338 ug/m3 (n=64; range 2 - 10,757 ug/m3). PM concentrations from personal grooming activities such as dressing, using hair spray, spray deodorant, etc. were 555 plus/minus 2848 ug/m3 (n=55; range 1 - 21,181 ug/m3). PM exposures outside the home were also identified. Mean concentrations while traveling were 142 plus/minus 265 ug/m3 (n=58; range 1 - 1669 ug/m3). Mean concentrations while inside at stores and restaurants were 152 plus/minus 372 ug/m3 (n=20; range 9 - 1682 ug/m3). Although the PM data are semi-quantitative, this analysis gives some insight into the relative exposures due to short duration activities (typically ranging from 15 to 45 min in duration) that cannot be identified using 24 hr average integrated PM mass measurements. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Heermance, E., Falconer, R., and Morgan, M.K. Enantiomeric composition of chiral pesticides in human adipose tissue and breast milk. Presented at: 223rd American Chemical Society National Meeting, Orlando, FL, April 7-11, 2002.

4/7/2002

Contact: Daniel M. Stout

Abstract: Examining the enantiomeric patterns of pesticides can provide a sensitive indicator of biological degradation. However, little work has been done to date on chiral pesticides in the human body. This study looks at the enantiomeric patterns of chiral pesticides and their chiral metabolites in human breast milk and adipose tissue. Samples showed selective degradation for several chiral organochlorine pesticides, although concentrations were near detection limits for many compounds. This work has been funded wholly or in part by the United States Environmental Protection Agency under an Agreement of Understanding with Renee Falconer. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Thomas, K.W., Sheldon, L., Sandler, D., Blair, A., and Alavanja, M.C.R. Agricultural health study/pesticide exposure study. Presented at: AHS National Advisory Panel Meeting, Rockville, MD, February 20-22, 2002.

2/20/2002

Contact: Kent W. Thomas

Abstract: The Agricultural Health Study (AHS) is a prospective epidemiologic study of a large cohort of pesticide applicators and their spouses in Iowa and North Carolina. The Pesticide Exposure Study is a sub-study to evaluate exposure factors and to provide data to assess exposure classification procedures. Exposure to the applied pesticides 2,4-D and chlorpyrifos is being measured for up to 140 applicators and their families. Applicators are selected based on application methods and uses of personal protective equipment often used by applicators in the epidemiological study cohort. Two exposure measurement approaches are being employed for all applicators monitored in the study: a) a combination of dermal patch, hand wipe, and personal air measurements collected during an observed handling, mixing, loading, and application (HMLA) and, b) urinary biomarker measurements from samples collected in the morning before and at two time intervals after the observed HMLA. First morning void urine samples are also being collected from participating applicator spouses and children to assess whether they may be indirectly exposed to the applied target pesticide. Field sample collection began in 2000 with 10 Iowa applicators monitored during April to August. Sample collection continued in spring and summer of 2001 with 41 new Iowa and 9 repeat Iowa applicators monitored. A total of 12 North Carolina applicators were also monitored in 2001. Field sample collection will conclude in 2002 in Iowa and North Carolina, with a goal of completing up to 65 additional applicator monitoring visits. Preliminary participation and measurement results will be shown for participants monitored through 2001, to the extent that they are available. This work has been funded in part by the U.S. Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names of commercial products does not constitute endorsement or recommendation for use.

Larson, T.V., Liu, L.J.S., Allen, R., and Lewtas, J. Indoor-outdoor-personal relationships of selected fine particle trace elements in Seattle, WA. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: The overall goal of this work is to better understand not only the sources of outdoor PM but also the sources that contribute to personal PM exposures. This paper summarizes the results of x-ray fluorescence (XRF) analysis on 24-hr PM_{2.5} samples collected both inside and outside the homes of subjects participating in a larger study characterizing PM exposures and examining the health consequences of PM_{2.5} exposures. Here we report the results for 238 indoor/outdoor pairs taken between Autumn 2000 and Autumn 2001. Of the 33 elements examined via XRF, 18 had median values above their detection limits (Al, Si, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Cu, Zn, As, Br, Sn, Ba and Pb). Of these latter species, only five had 75th percentile indoor-outdoor ratios less than one (S, K, V, Fe, and Pb); in contrast, six had corresponding ratios above 1.5 (Al, Si, Cl, Ca, Cr, Cu) indicating significant contributions from indoor sources for most elements. The correlations between indoor and outdoor levels were examined by performing a factor analysis on each of the 238 indoor samples and comparing these factor scores with those obtained from a similar analysis of the corresponding 238 outdoor samples. Three features with eigenvalues >1 were extracted from the outdoor samples. These included: 1) a soil-like feature exhibiting high correlations between Al, Si, Ca, Fe, and Ti; 2) a feature driven by high correlations between S, K, Cu, Zn, As and Se; and 3) a separate Mn/Br/Pb feature. Interestingly, three similar features were extracted independently from the corresponding indoor samples. Feature #2 was most strongly associated with PM_{2.5} mass in both indoor and outdoor samples ($R^2=0.88$). It is premature at this time to attribute feature #2 and #3 to specific source categories. However, in an effort to uncover more correlated features, we are currently extending these analyses to encompass additional analytes, including temperature resolved particulate carbon measurements that are available for all these indoor-outdoor pairs. In addition, XRF results from personal samples will be included in the analysis for identifying sources attributed to personal PM_{2.5} exposures. We also plan to compare the above results with those obtained using two alternative multivariate models, partial least squares and 3-D positive matrix factorization. This work has been funded wholly by the United States Environmental Protection Agency under EPA Cooperative Agreement number (#R82717701) and the EPA/UW Northwest Center for Particulate Matter and Health (R-827355-01-0). It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Wilson, N.K., Iachen, R., Chuang, J.C., Gordon, S.M., Evans, G.F., Feder, P., Strauss, W., Ozkaynak, H., and Sheldon, L.S. Children's total exposure to persistent pesticides and other persistent organic pollutants (CTEPP): an overview. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ellen W. Streib

Abstract: Young children may have greater exposures to pollutants in their everyday environments than do adults. Because of their immaturity, rapid development, and smaller body masses, children may also be more susceptible to the effects of these pollutants. Recent federal health initiatives promote research to fill in data gaps on young children's exposures. The Food Quality Protection Act specifically requires children's exposure assessments, including aggregate exposures from all sources, and prescribes additional protective assumptions in estimating children's exposures. CTEPP has two major objectives: (1) to measure the total (aggregate) exposures of a small set of children, ages 18 months to 5 years, and their primary care givers in selected North Carolina and Ohio counties, to a suite of persistent pesticides and other persistent organic pollutants (POPs) in their everyday environments, and (2) to apportion the exposure pathways and identify hypotheses to be tested in future research. Several hypotheses will be tested in CTEPP, including whether the children's exposures are the same: (a) at home and daycare, (b) in low-income and middle-income households, (c) in urban and rural environments, (d) as those of adults in the same households, and (e) through different exposure pathways for different chemical classes of pollutants. Additionally, CTEPP will test whether (f) ingestion is a major pathway for exposures of the children and adults, and (g) diet is the major contributing factor to the children's ingestion exposures. Data obtained in our earlier studies of young children's exposures to polycyclic aromatic hydrocarbons (PAH) and to persistent organic pollutants at home and at daycare are used to calculate sample sizes for the CTEPP study. A sample size of 128 children per group allows detection of a 50% difference between groups at 90% power, if the standard deviation of the log-transformed POP concentrations is 1.0. This is achieved through stratified random sampling of 260 participants. However, the CTEPP data cannot be generalized to larger populations of children. Targeted pollutants are from these chemical classes: organochlorine, organophosphorus, and pyrethroid pesticides, as well as polychlorinated biphenyls, phenols, PAH, triazines, and phthalates. Sampled media are: air, house dust, soil, food preparation surface and floor wipes, duplicate diet, drinking water, hand wipes, and urine. Ancillary data include household characteristics, time-activity diaries, and videotapes of ~10% of the children. A comprehensive database is being developed. Future CTEPP work includes exposure calculations, statistical data analysis, hypothesis testing, and interpretation. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract #68-D-99-011 to Battelle. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Williams, R, Rea, A.W., Suggs, J.C., Leovic, K., Vette, A.F., Sheldon, L.S., Rhodes, C, Thornburg, J., Ejire, A., and Sanders, Jr., W. Exposure assessment from the NERL Research Triangle Park particulate matter panel study. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: The U.S. Environmental Protection Agency performed a particulate matter (PM) exposure assessment based on data from the National Exposure Research Laboratory (NERL) Research Triangle Park (RTP) Particulate Matter (PM) Panel Study. This study was a one-year investigation of PM and related co-pollutants involving two distinct subpopulations living within the RTP area of North Carolina. Primary goals were to characterize the relationships between ambient and residential PM measures to those obtained from personal exposure monitoring and estimate ambient source contributions to personal and indoor mass concentrations. A total of 35 participants were involved in personal PM_{2.5} exposure monitoring. Participating were 27 nonsmoking hypertensive African-Americans living in a low-moderate SES neighborhood (SE Raleigh, NC) and a multi-racial cohort of eight individuals having implanted cardiac defibrillators (Chapel Hill, NC). The volunteers were monitored for seven consecutive days during four consecutive seasonal periods (summer 2000, fall 2000, winter 2001, spring 2001). Results indicated that daily personal PM_{2.5} mass concentrations were typically higher than their associated residential or ambient measurements (e.g., hypertensive cohort mean personal = 27.6, indoor = 21.7, outdoor = 18.9, ambient = 18.9 ug/m³). Individual PM_{2.5} personal exposure concentrations were observed to range from 4 to 218 ug/m³ during the entire study period. Mean observed correlations between personal PM_{2.5} exposures and other ambient-based measurements varied significantly by season ($r = 0.3$ to 0.8). Factors influencing these variations are being investigated. Ambient PM_{2.5} mass concentrations were determined to be highly representative of those obtained from outside each residence regardless of season or distance ($r > 0.8$). PM_{2.5} personal cloud estimates for both cohorts averaged ~ 10 ug/m³ across the study. Mixed effects modeling indicates that ambient sources accounted for approximately 50% of the personal PM_{2.5} mass concentrations. Ranges of these estimates will be presented along with other summary findings. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Sheldon, L., Williams, R.W., Suggs, J.C., Evans, G.F., Rea, A.W., Vette, A.F., Burke, J.M., Croghan, C.W., Leovic, K.W., Creason, J.P., Walsh, D., Rodes, C., Thornburg, J., Lawless, P., Ejire, A., and Sanders, Jr., W. Summary findings from the U.S. EPA's particulate matter panel studies. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: The U.S. EPA's Particulate Matter Panel Studies were a series of longitudinal human exposure studies used to characterize personal exposures to particulate matter (PM) and related co-pollutants to that of pollutants of ambient origin. Participants were monitored over time (28 days) to investigate both longitudinal and cross-sectional correlations between personal, residential indoor, residential outdoor, and ambient measurements. The studies involved 75 volunteers from Baltimore, Maryland (1998); Fresno, California (1999) and Research Triangle Park, North Carolina (2002-2001) and were designed to evaluate different sub-populations, regions of the country, seasons, and housing conditions. Susceptible sub-populations (55 years old) included healthy individuals along with a majority having various pulmonary and cardiovascular diseases. Daily PM_{2.5} and/or PM₁₀ mass concentrations were determined in each study. Copollutants included CO, O₃, NO₂, SO₂, and metals. Information on time/activity patterns and potential sources of PM exposure were collected for each participant through daily survey/questionnaire instruments. A total of more than 7000 PM mass measurements were obtained. Data indicates that the magnitude and variability of personal PM_{2.5} exposures can vary significantly (3 to 200 $\mu\text{g}/\text{m}^3$) depending upon individual activity patterns and exposure factors such as season, geographical setting and/or housing conditions. The same holds true for spatial associations (eg., personal to ambient mass correlations varied between 0.0 to 0.95). Mean personal PM_{2.5} clouds from 3 to 10 $\mu\text{g}/\text{m}^3$ were observed in the different participant populations. Estimations of outdoor source contributions to personal PM_{2.5} mass concentrations using a number of mixed modeling effects ranged from 8 to 10 $\mu\text{g}/\text{m}^3$ in the latest Research Triangle Park-based study. These data indicate that ambient PM_{2.5} sources typically contributed approximately 50% to the total personal exposure mass concentration. Methodologies employed to collect data concerning potential contributions from other sources (eg., cooking, household cleaning) to personal PM exposures based on real-time personal and indoor nephelometry data will be reported. Development of the new techniques to estimate personal monitoring compliance using activity sensors and procedures to determine the impact of HVAC duty cycles upon individual residences will also be presented. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D5-0040 and 68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Williams, R.W., Riediker, M., Sheldon, L.S., Devlin, R.B., Griggs, TR, Stevens, Carvin, Pleil, J.D., and McCorquodale, Steve. Preliminary findings on the assessment of potential car-related occupational PM and air toxic exposure to patrol troopers (COPP study). Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: In-vehicle, roadside and community-based measurements of particulate matter (PM) and select air toxics were measured as part of a study involving patrol cars from the North Carolina Highway Patrol. One goal of this study was to characterize PM and related air pollutant concentrations associated with vehicle operations in and around Wake County, North Carolina during the patrol officers' normal 8-hr duty schedule. We also assessed the magnitude and variability of selected air pollutants and their temporal/spatial relationships. The study design consisted of repeated daily measurements of PM_{2.5}, volatile organic carbon (VOCs), polynuclear aromatic hydrocarbons (PAHs), elemental carbon (EC), aldehydes, carbon monoxide, nitrogen oxides and ozone mass concentrations. PM_{2.5}, PAH, and CO were measured in real-time while the others were integrated samples. A total of 50 monitoring days involving vehicles from 10 participating patrol officers were performed between August 16th and October 4th 2001. Preliminary data analyses from in-vehicle trials indicate a mean real-time PM_{2.5} mass concentration of 24 $\mu\text{g}/\text{m}^3$ with a range of 4 to 54 $\mu\text{g}/\text{m}^3$ (7 to 59 $\mu\text{g}/\text{m}^3$ using collocated impactor filter-based monitors). Concentrations of PAHs made up of three to five ring structures ranged from 7 to 64 ng/m³ (mean = 21 ng/m³). CO levels averaged 2.6 ppm with the maximum observed 8-hr concentration < 6 ppm. A majority of the 15 selected vehicular emission-related carbonyls were determined to be at detectable concentrations in most of the trials. This included compounds such as formaldehyde, acetaldehyde and acetone. These three carbonyls typically had in-vehicle concentrations of 10 to 20 $\mu\text{g}/\text{m}^3$. Time series examples of other in-vehicle real-time data collections will be presented. An investigation of potential linkages between exposure findings and select health effects in the participants, such as lung function and heart rate, was also performed as a component of this study and will be presented in an accompanying abstract. This work has been funded by the United States Environmental Protection Agency under cooperative agreement # CR-824915 to the University of North Carolina-Chapel Hill, and contract 68-D-00-206 to ManTech Environmental Technology, by the North Carolina State Highway Patrol, and by the Swiss National Science Foundation. It has been subjected to Agency review and approved for publication but does not necessarily reflect EPA policy.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Thomas, K.W., Sheldon, L.S., Gordon, S.M., Jones, M., Reynolds, S., Raymer, J., Akland, G.G., and Dosemec, M. Interim results from the agricultural health study/pesticide exposure study. Presented at: International Society for Exposure Analysis, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Kent W. Thomas

Abstract: The Agricultural Health Study (AHS) is a prospective epidemiological study of pesticide applicators and their spouses in Iowa and North Carolina. Exposure to 2,4-D or chlorpyrifos is being measured for a subset of applicators in the AHS Pesticide Exposure Study to assess exposure classification procedures. Applicators are selected based on their use of specific application methods and personal protective equipment. Potential exposures are measured on one day of pesticide mixing, loading, and application (MLA) using dermal patch, hand wipe, and personal air samples. Dermal samples are collected by placing ten cellulose or gauze patches on the body, with each patch sized proportionately to the body area it represents. Patches are combined for analysis. Hand wipe samples are collected using a sub-sampling technique that wipes approximately 10% of the hand surface area. Urinary biomarker levels are measured in pre- and post-application samples from each applicator and from participating spouses and children. Questionnaires and observations of MLA activities provide information about work practices, use of protective equipment, and hygiene. Field monitoring has been completed for 72 applicators, 35 spouses, and 10 children in 2000 and 2001 in Iowa and North Carolina and will continue in the spring/summer of 2002. Preliminary measurement results for urinary biomarkers show levels of 2,4-D in applicators' first post-application urine samples ranging from <1 to 480 g/g creatinine. Use of 2,4-D on days before and after the monitored MLA affected pre- and post-application urinary levels for some applicators, with 130 g/g creatinine measured prior to the monitored MLA for one applicator, and 1100 g/g creatinine measured several days after the monitored MLA for another. Spouse and child urinary biomarker levels of 2,4-D were <10 g/g creatinine, except for 68 g/g creatinine measured for one spouse. Urinary levels of the 3,5,6-trichloropyridinol metabolite of chlorpyrifos ranged from 2 to 16 g/g creatinine for chlorpyrifos applicators, their spouses, and children. Based on results for the eight 2,4-D and two chlorpyrifos applicators monitored in 2000, estimated dermal exposures ranged from 7 to 20,000 g per MLA activity (assuming 10% penetration of clothing) and estimated inhalation exposures ranged from 1 to 24 g per MLA activity. The two farmers applying a granular chlorpyrifos product experienced the lowest dermal and inhalation exposures. Measurement results and relationships between measurements, observed work practices, and the amount of applied active ingredient will be presented for all applicators monitored through the first two years. This work has been funded in part by the U.S. Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names of commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Cohen-Hubal, E.A., Akland, G.G., Leovic, K., Raymer, J., and Sheldon, L.S. Feasibility of using the macroactivity approach to assess children's dermal exposure to pesticides. Presented at: 12th Conference of the International Society of Exposure Analysis, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Elaine A. Cohen-hubal

Abstract: Results from an initial assessment of critical exposure pathways for children indicate that dermal contact may result in high residential exposures to pesticides. However, data on children's exposures and activities are insufficient to support quantitative assessments that do not rely heavily on major default assumptions as substitutes for missing information. In addition, approaches for measuring and assessing dermal exposure in a residential setting have not been evaluated. In the macroactivity approach, dermal exposure is estimated using empirically-derived transfer coefficients. This approach was developed to assess occupational exposure in an agricultural setting. To assess the feasibility of using the macroactivity approach for assessing children's exposure to pesticides, a screening-level study was conducted with young children in a daycare center where a known pesticide application had occurred. Children in the selected daycare were monitored the day following a regularly scheduled monthly application of esfenvalerate. Four or five children from each of two different age groups (6-12 months, and 2-3 years) were monitored for 30-60 minutes while involved in selected activities (e.g., storytime, playtime indoors). The children were clothed in full-body cotton suits to measure dermal loading. Transferable residues were sampled in the areas where the children spent time to measure the pesticide concentrations on classroom surfaces. In addition, videotaping was conducted to verify the children's activity levels and location during exposure monitoring. Monitoring of these two groups of children was repeated during two additional post-application visits. The dermal loading and transferable residue measurements were then used to calculate dermal transfer coefficients for each monitoring event. The results of this study demonstrate the inter- and intra-individual variability of dermal loading (and associated transfer coefficients) for children in two different age groups. Preliminary results show surface wipe concentrations ranging from 37-458 ng/cm² and total body suit concentrations ranging from 0.04-0.6 ng/cm². These data will be used to evaluate the default assumptions currently used by US EPA's Office of Pesticide Programs to assess children's residential exposure to pesticides. This work has been funded by the United States Environmental Protection Agency under contract no. 68-D-99-012 to Research Triangle Institute. It has been subjected to Agency review and approved for publication.

Brinkman, M.C., Finegold, J.K., Chuang, J.C., Lyu, C., Cashwell, J., Wilson, N.K., Gordon, S.M., Morgan, M.K., and Croghan, C. The CTEPP Database. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ellen W. Streib

Abstract: The CTEPP (Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants) database contains a wealth of data on children's aggregate exposures to pollutants in their everyday surroundings. Chemical analysis data for the environmental media and questionnaire response data are stored in a series of tables that can be linked using the 6-digit, unique participant identification number (PID). Users can query both analytical and questionnaire data simultaneously to examine possible relationships between pollutant exposures and human activities. The environmental media analysis data include core analytical data, quality assurance and quality control data, and ancillary field data. Data field descriptions and restrictions for these three tables are outlined in the dictionary and code set tables. The CTEPP database incorporates analytical data from 12 different environmental matrix types, which were collected from subjects from 257 households, and analyzed for over 50 target analytes per sample. The questionnaire response data include recruitment survey, pre- and post-monitoring interviews, child activity and food diary, adult diary, daycare center menu, and house/building survey data. Combined, the analytical and questionnaire data for the CTEPP North Carolina and Ohio components, when completed, will total almost four million data points. The CTEPP database, one of the largest databases of children's exposure data in the United States, is a valuable resource that EPA will make available in the future to interested researchers and the public. We discuss here the database design and format of the analytical and questionnaire data. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract 68-D-99-011 to Battelle. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Chuang, J.C., Junod, N., Wilson, N.K., Brinkman, M.C., and Morgan, M.K. Multimedia chemical analysis plan for children's aggregate exposure field studies in North Carolina and Ohio. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ellen W. Streib

Abstract: The samples collected in the CTEPP North Carolina and Ohio field campaigns were analyzed for a suite of organic chemicals in various compound classes, chosen because of their possible carcinogenicity, acute or chronic toxicity, or potential for endocrine system disruption. The targeted compound classes include acid herbicides, carbamates, chlorinated phenols, hydroxy-polycyclic aromatic hydrocarbons (OH-PAHs), organochlorine (OC) pesticides, organophosphate (OP) pesticides, PAHs, polychlorinated biphenyls (PCBs), phthalate esters (PHs), alkylphenols, pyrethroid pesticides, and triazines. Analytical methods for the chemical characterization of these compounds were based on methods developed previously in small-scale pilot studies. A cost-effective approach was established for the sample analysis effort. This approach divided the compound classes into two groups: neutral/moderately polar (carbamates, OC and OP pesticides, PAHs, PCBs, PHs, pyrethroids, triazine, and alkylphenols) and polar (acid herbicides, OH-PAHs, and chlorinated phenols). Because of cost constraints, we consolidated the moderately polar compounds with the neutral compounds into a single group. Different sample extraction and cleanup methods were used for the neutral/moderately polar and the acid groups. Within each group, different extraction/cleanup methods were required for the various sample matrices of interest. The sample matrices included air, dust, soil, dermal wipe, surface wipe, food, drinking water, and urine. For the neutral/moderately polar group, the sample extract had to be analyzed twice to cover all the target chemicals. The polar group required two derivatization methods (methylation and silylation) and two (GC/MS) analysis runs. A total of 30 standard operating procedures were generated to describe the various chemical analysis methods. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract No. 68-D-99-011 to Battelle. It has been subjected to Agency review and approved for publication.

Morgan, M.K., Wilson, N.K., Chuang, J.C., Junod, N., Brinkman, M.C., and Lyu, C. Levels of organochlorine, organophosphate, and pyrethroid pesticides in CTEPP North Carolina multimedia samples. Presented at: International Society of Exposure Analysis 2002, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ellen W. Streib

Abstract: CTEPP (Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants) is a pilot study of the possible exposures of 257 preschool children and their primary adult caregivers to pollutants commonly found in their everyday environments. Sampling was performed over 48-hr periods at the children's daycare centers and individual homes in 12 counties in North Carolina and Ohio. Collected media included duplicate diet, drinking water, urine, indoor and outdoor air, floor dust, play area soil, transferable residues, and wipes (hand, floor, and food preparation). The samples from North Carolina have been extracted and analyzed chemically by GC/MS for many pesticides including organochlorines (OCs), organophosphates (OPs), and pyrethroids. Most of the OC pesticides are no longer used in the United States. The OP pesticides are still used, especially for nonresidential applications. However, in homes and child daycare centers, they are increasingly replaced by pyrethroids. We measured the OCs aldrin, -chlordane, -chlordane, dieldrin, p,p'-DDE, p,p'-DDT, endrin, lindane, and heptachlor, the OPs diazinon and chlorpyrifos, and the pyrethrins cis-permethrin, trans-permethrin, and cyfluthrin. Here we report the preliminary results for levels of the OC, OP, and pyrethroid pesticides found in multiple environmental media collected in the child daycare centers and homes of 130 North Carolina preschool children. Of all the measured pesticides, cis-permethrin and trans-permethrin were the most abundant in indoor floor dust (54.8 and 48.4 ug/g), dermal wipes (32.5 and 32.7 ug/sample), food preparation wipes (201.8 and 208.9 ug/m2), and transferable residues (34.0 and 36.3 ug/m2), respectively. The mean concentrations of cis- and trans-permethrin were 3.4 and 3.3 ug/g (indoor floor dust), 0.3 and 0.3 ug/sample (dermal wipes), 16.6 and 17.4 ug/m2 (food preparation wipes), and 5.9 and 6.4 ug/m2 (transferable residues), respectively. Trans-permethrin was also the most abundant pesticide in floor wipes (10.1 ug/m2). Diazinon was the most abundant pesticide in soil (8.2 ug/g), indoor air (1.9 ug/m3), and outdoor air (0.2 ug/m3). This work has been funded wholly or in part by the United States Environmental Protection Agency under contract #68-D-99-011 to Battelle. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Gordon, S.M., Brinkman, M.C., Satola, J., Wallace, L.A., Weisel, C.E., and Shin, J.Y. Controlled, short-term dermal and inhalation exposure to MTBE and dibromochloromethane. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: The oxygenate methyl tert-butyl ether (MTBE) has been added to gasoline to meet national ambient air quality standards in those parts of the US that are non-compliant for carbon monoxide. Although MTBE has provided important health benefits in terms of reduced hazardous air pollutants, the increasing occurrence and detection of MTBE in drinking water sources in California, New Jersey, and elsewhere has raised concerns about potential exposures from water usage and resulting health effects. In addition to MTBE, disinfection byproducts can be present in the water people use for showering, bathing, or drinking, as a result of the reaction of disinfection agents with organic material already present in water. Chlorine reacts with humic acids to form the trihalomethanes, which are the most common and abundant byproducts in chlorinated water. Besides chloroform, which has been widely studied, the byproduct dibromochloromethane (DBCM) occurs as a result of the chlorination process in those areas that naturally have bromide in their ground water. Relatively little information on exposure to this chemical is available. We conducted studies to determine the uptake by humans of MTBE and DBCM as a result of controlled, short-term dermal and inhalation exposures. Our approach made use of continuous real-time breath analysis to generate exhaled-breath profiles and evaluate MTBE and DBCM kinetics in the body. In the dermal exposure study, real-time breath analysis was used to measure the absorption of MTBE and DBCM while bathing in contaminated water. Seven subjects bathed in water containing MTBE-d12 (at ~150 µg/L) and DBCM (at ~40 µg/L) at 40°C for 30 minutes. The breath profiles obtained for MTBE and DBCM were qualitatively similar to those for chloroform obtained in a previous study, but the amounts of MTBE and DBCM dermally absorbed were significantly lower than in the case of chloroform. In the inhalation study, seven subjects were exposed continuously to 500 ppb MTBE-d12 and 115 ppb DBCM, except for several brief (2-min) intervals in which breath measurements were taken. Total exposure time was 30 min, followed by exposure to clean air for ~30 min. Exhaled breath was sampled and analyzed with the real-time breath technology; blood samples were simultaneously collected from the subjects (3-4 samples during exposure; 2-5 samples post-exposure). The real-time technology was specially modified with a biofeedback exposure control system to allow us to make uptake measurements during the exposure period; breath measurements were continuous throughout the post-exposure period. The uptake and decay of the target chemicals in the blood was estimated by fitting the exposure and post-exposure breath and blood data to a multi-compartmental model that estimated residence times. The measurements also provided information on blood:breath concentration ratios, as well as the fraction of breath MTBE and DBCM exhaled unchanged at equilibrium. This abstract has been reviewed in accordance with US Environmental Protection Agency's peer and administrative review policies and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Wallace, L.A., and Ott, W.R. Application of the random component superposition (RCS) model to PM2.5 personal exposure and indoor air quality measurements in different cities. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: The RCS model allows us to estimate the distribution of population exposure to air pollutants in any city given only the outdoor measurements in that city. Since outdoor measurements are made in many cities, but personal exposures are measured in few, the model could conceivably be very useful. The fundamental assumption of the model is that the distribution of exposures to pollutants emitted by personal and indoor sources is invariant across cities. Although of course cities have somewhat different levels of smoking, frequency of open windows, etc., it is at least testable whether these differences significantly affect the observed distribution of exposures. To test the model, it is necessary to have probability-based studies of personal exposure, including outdoor measurements, in two cities. From these measurements, one can separate the outdoor from the non-outdoor (indoor and personal) components of personal exposure. One can then use the outdoor measurements in one city to estimate the total personal exposure measurements in the other, by simply adding the invariant distribution of non-outdoor exposures to the measured outdoor concentrations in the second city. This predicted distribution of total exposures can then be compared to the observed distribution to test the adequacy of the model. Besides estimating personal exposures, the model can also estimate indoor concentrations given the proper probability-weighted fixed indoor measurements. The RCS model has been applied with success to PM10 indoor and personal exposure measurements from field studies conducted in 3 cities - Toronto, Canada; Phillipsburg, NJ, and Riverside, CA. Until recently, only one probability-based personal exposure study of PM2.5 was available (Toronto, Canada), but the completion of a second probability-based personal exposure study in Indianapolis has made it possible to test the model for PM2.5 as well as PM10. Indoor PM2.5 measurements made in Riverside, CA; Toronto, Canada; and Indianapolis will also be explored in this paper. Regression analysis is useful for applying the RCS model to personal and indoor air measurements, because the physically based superposition model of indoor concentrations and personal exposures yields the same basic equation used in the standard linear regression model. Thus, regression approaches, when applied in RCS modeling, yield parameter values that have an important physical interpretation, such as the particle exposure attenuation factor $a = pa/(a + k)$, where p is the penetration factor, a is the air exchange rate, and k is the particle deposition rate. This abstract has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Tulve, N.S., Whitaker, D., Fortmann, R., Brown, H., Bozeman, E.R., Hilliard, A., and Naeher, L.P.
Environmental measurements of organophosphate and pyrethroid pesticides to assess
exposures of young children living in Jacksonville, FL. Presented at: International Society of
Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Nicolle S. Tulve

Abstract: The Duval County Health Department (DCHD, Jacksonville, FL), in collaboration with the Centers for Disease Control and Prevention (CDC) and the US Environmental Protection Agency (EPA), conducted a research study to characterize young children's potential exposures to organophosphate and pyrethroid pesticides. The overall objectives of this study were to: (1) measure the urine metabolite levels of organophosphate and pyrethroid pesticides from a group of 4-6 year old children living in the greater Jacksonville area, (2) identify possible household sources of these pesticides by performing screening measurements and pesticide inventories, (3) investigate whether the environmental pesticide levels correlate with the biological levels, and, (4) correlate questionnaire exposure information with the environmental data. The study was designed as a three-tiered approach: tier 1: recruitment of 200 children into the study, completion of a questionnaire, and collection of a urine sample from each participating child; tier 2: collection of environmental screening samples from approximately 25% of the children who participated in tier 1; tier 3: a detailed exposure assessment in nine of the homes sampled in tier 2. Participation in tier 2 was dependent on the answers to the pesticide related questions in the initial questionnaire. Participation in tier 3 was dependent on both the answers to the pesticide related questions in the initial questionnaire and the results of the household pesticide inventory. Results of the pesticide inventory showed that synthetic pyrethroids were the primary pesticides used in the residences. Data from tiers 1 and 2 will not be presented in this paper. For the nine participants in tier 3, an aggregate exposure assessment was performed that included the collection of environmental (surface wipes, transferable residues, indoor/outdoor air) and personal samples (a time activity diary, pesticide residues on cotton socks, duplicate diet, urine) to evaluate potential exposure from each route (inhalation, dermal, dietary, indirect ingestion). Data from the aggregate exposure assessment will be presented (tier 3). These data will be used to evaluate the exposure algorithms developed by EPA as part of its draft protocol on how to conduct an exposure assessment study with young children. Data will also be presented on the applicability of questionnaire responses as predictors for environmental loadings of pesticide residues. This work has been funded in part by the United States Environmental Protection Agency under an EPA Technical Services Contract (Contract No. 1D-5377-NAGX) to the Duval County Health Department. It has been subjected to Agency review and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Brown, K.W., Suh, H.H., Wallace, L.A., and Koutrakis, P. Indoor and outdoor source contributions to personal PM_{2.5} for a panel of individuals with cardiovascular disease or COPD living in Boston, MA. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: Repeated personal, home indoor, home outdoor, and ambient particulate and gaseous pollutant levels were characterized for individuals with cardiovascular disease or COPD and their partners living in the Boston area. Health status was determined by self-reported history of myocardial infarction, bypass surgery, angina or physician-diagnosed COPD. These individuals were monitored for seven consecutive days during winter 1999-2000 and/or summer 2000. Subjects wore a multi-pollutant monitor to collect simultaneous 24-hour integrated samples for each of the following pollutants: PM_{2.5}, PM₁₀, sulfate, elemental carbon (EC), O₃, NO₂, and SO₂. In addition, home characteristic information was collected for all participants, and 24-hour air exchange rates were measured for each home during each day of the study. Indoor and outdoor measurements at each home were made using the same multi-pollutant sampler. In addition to wearing the sampling equipment, all participants completed daily time-activity diaries in which they recorded their activities and locations throughout the day. Motion sensors with built-in data loggers were also included in the sampling packs worn by participants to better assess compliance with personal monitoring. During each season of the study 154 person-days of personal data were collected. In each season, approximately half of the 15 homes had two personal measurements on a given day due to participation by partners. The LOD for personal PM_{2.5} levels was 5.6 ug/m³ in winter and 6.2 ug/m³ in summer. For EC, the LOD was 0.6 ug/m³ in winter and 0.3 ug/m³ EC in summer. The mean personal PM_{2.5} concentration was 14.2 ug/m³ in winter (med.=11.2, n=145, sd=10.6) and 13.0 ug/m³ (med.=12.0, n=138, sd=8.1) in summer, while corresponding ambient levels were 9.8 (med.=9.2, n=156, sd=5.3) and 11.2 (med.=10.5, n=147, sd=5.8), respectively. The mean personal EC concentration in winter was 1.5 ug/m³ (med.=1.2, n=148, sd=1.6), while the ambient EC concentration was 1.1 (med=0.8, n=139, sd=0.6). In summer, personal EC was 1.8 ug/m³ (med.=1.8, n=141, sd=0.6) and ambient was 1.3 ug/m³ (med.=1.4, n=138, sd=0.4). The relationship between personal and ambient PM_{2.5} differed by season, with a median subject-specific Spearman correlation coefficient of 0.29 in winter and 0.71 in summer. For EC, the personal-ambient association was similar in summer and winter (median rs=0.54 in winter and 0.50 in summer). This paper will use mixed models to address indoor and outdoor contributions to personal PM_{2.5}, PM₁₀ and gaseous pollutant exposures. The influence of activity patterns and housing characteristics on the source contributions to personal PM_{2.5} will also be evaluated. Finally, to address the reliability of using EC as a tracer for ambient pollution, we will analyze the spatial variability of EC within the Boston region during winter and summer sampling seasons. This work has been funded wholly by the United States Environmental Protection Agency under EPA Cooperative Agreement # (CR827159). It has been subjected to agency review and approved for publication.

Allen, R., Larson, T.V., Wallace, L.A., and Liu, L.-J.S. The use of light scattering data to estimate the contribution of indoor- and outdoor-generated particles to indoor air. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: Many epidemiologic studies have shown an association between adverse health effects and particulate concentrations measured at centrally located sites. Other studies have been conducted to examine relationships between personal exposures and central site measurements. Few studies quantify the contribution of indoor and outdoor sources to personal exposures, as particles in these two environments differ in sources and composition, and exhibit temporal and between-residence variability. This study is a subset of a larger exposure assessment study conducted between October 99 and May 01. Subjects were recruited throughout the metropolitan Seattle area, including 67 elderly and 18 pediatric asthmatics. Particle mass and light scattering were monitored on 19 subjects and at 85 residences, including 42 apartments or group homes, and 43 private homes. This paper uses a censoring technique to identify and remove indoor sources from the continuous light scattering measurements. We then apply a mass balance model to the censored time series data to estimate the contribution of indoor- and outdoor-generated particles to indoor air and to personal air. The real-time personal exposure measurements are combined with the real-time indoor and outdoor particle measurements, time-activity-location information, potential particle events, and home ventilation logs to determine the contributions from various indoor and outdoor particle sources to total personal PM exposure. The particle infiltration efficiency averages 0.53±0.25 and differs significantly across dwelling types and by season. Despite having higher outdoor particle concentrations and spending more time outdoors, the pediatric subjects, as compared to elderly subjects, have no higher exposure to ambient particles. This paper has been reviewed in accordance with US Environmental Protection Agency's peer and administrative review policies and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Chang, L.T., Suh, H.H., Wheeler, A., Koutrakis, P., Lau, G., Turpin, B., Colome, S., and Wallace, L.A. Personal, indoor, and outdoor concentrations of PM_{2.5}, particulate nitrate, and elemental carbon for individuals with COPD in Los Angeles, CA. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: This study characterizes the personal, indoor, and outdoor concentrations of PM_{2.5} and the major components of PM_{2.5}, including nitrate (NO₃⁻), elemental carbon (EC), and the elements for individuals with chronic obstructive pulmonary disease (COPD) living in Los Angeles, CA. Monitoring was performed for 15 participants for 7 consecutive days in the winter and summer of 2000, respectively. During each sampling day, 24-hr personal, indoor, and outdoor samples of the targeted pollutants was collected simultaneously. Housing characteristic information and time-activity diaries were also obtained. In each season, participants reported spending approximately 87% of each day within their residences. The overall 24-hr mean personal exposures to PM_{2.5}, NO₃⁻, and EC were 22.40 (+18.17), 1.43 (+1.06), and 1.13 (+1.20) g/m³, respectively. Significant seasonal differences were found for all of the PM_{2.5}, NO₃⁻ and EC measures, except for outdoor NO₃⁻, where no seasonal difference was observed. Personal PM_{2.5} exposures were higher than corresponding indoor and outdoor concentrations in both seasons, while the same pattern was not persistent among the major components of PM_{2.5}. Higher outdoor nitrate concentrations, as compared with the corresponding measurements, were found in both seasons, which reflects the fact that the major sources of nitrate are from motor vehicles. Additionally, a similar but less distinct pattern was shown for elemental carbon concentrations. Personal exposures were significantly correlated with both indoor and outdoor concentrations for PM_{2.5}, NO₃⁻, and EC in both seasons, as were those between indoor and outdoor concentrations. The association between personal PM_{2.5} exposures and corresponding outdoor levels was stronger in the summer (Spearman correlation coefficient, $r_s = 0.62$), as compared to that in the winter ($r_s = 0.52$). In addition, indoor PM_{2.5} concentrations were more strongly correlated with personal exposures during the wintertime ($r_s = 0.77$), as compared to the summertime ($r_s = 0.63$). Longitudinal analyses were conducted to account for the repeated measurements for each subject. For PM_{2.5}, the relationship between personal exposures and indoor/outdoor concentrations followed patterns observed in previous studies, where the effect of indoor concentrations on personal exposures became more dominant in the winter due to the low air exchange rate. This work has been funded by the U.S. Environmental Protection Agency under EPA Cooperative Agreement number (CR 827159-01-0). It has been subjected to Agency review and approved for publication.

Liu, L.-J.S., Kalman, D., Kaufman, J., Koenig, J.Q., Larson, T.V., Sheppard, L., Lewtas, J., and Wallace, L.A. Characterization of particulate matter and co-pollutants exposures for compromised and healthy elderly adults in Seattle, WA, 1999-2001. Presented at: International Society for Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: This paper presents results from a 2-year comprehensive exposure assessment study that examined the PM exposures and health effects in individuals with and without chronic obstructive pulmonary disease (COPD) and cardiovascular (CV) diseases. Forty-six COPD, 21 CV, and 42 healthy subjects living in private and group homes participated in the monitoring sessions between fall 1999 and Spring 2001. Personal, indoor, and outdoor PM₁₀, PM_{2.5}, CO, NO₂, SO₂ were monitored for 10 consecutive days for each subject. Harvard impactors (HI) and Nephelometers were used for PM_{2.5}, PM₁₀, and PM₁ measurements at indoor, outdoor, and central sites. Harvard personal environmental monitors (HPEM) and personal DataRAMs were used for personal PM_{2.5} and PM₁₀ monitoring. This paper focuses on relationship between fixed site and personal PM and co-pollutants measurements among susceptible subpopulations. No significant differences in PM and co-pollutants exposures were observed between COPD and healthy subjects. Longitudinal correlation for personal exposures to PM_{2.5} and alveolar CO concentrations ranged between 0 and 0.78 (median=0.11). Cross-sectionally, central site PM_{2.5} and PM₁₀ were weakly but significantly related to personal PM_{2.5} exposures ($r=0.17-0.29$) in both elderly COPD and healthy sub-populations. The longitudinal correlation coefficients for personal PM_{2.5} exposures and central site measurements calculated for each subject ranged between 0 and 0.79. The average daily PM_{2.5} outside the individual home sites was significantly correlated with PM_{2.5} measured at the central site ($R^2 = 0.92$, slope = 1.00). Using the random component superposition model, we estimated that 40% of the personal PM_{2.5} exposures could be contributed to ambient sources, while 60% was from non-ambient sources. Exposure models are constructed to determine factors affecting the strengths of the relationships between personal exposures and central site measurements. This abstract has been reviewed in accordance with US Environmental Protection Agency's peer and administrative review policies and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Wheeler, A., Suh, H., Koutrakis, P., Reid, C., Wallace, L.A., and Ryan, B. Analysis of components of particulate matter (PM_{2.5}) for an exposure assessment study of two sensitive cohorts in Atlanta, GA. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Lance A. Wallace

Abstract: Introduction An exposure assessment study was conducted in Atlanta, GA during fall 1999 and spring 2000 to examine the short-term effects of exposure to particulate matter and gaseous air pollutants on heart rate variability (HRV). Characterization of particulate matter (PM_{2.5}) for personal, indoor and outdoor environments will be presented for both seasons. Methodology Personal exposure monitoring along with indoor and outdoor sampling was conducted for a group of individuals with chronic obstructive pulmonary disease (COPD) or recent myocardial infarction (MI). In the Fall component of the study, 24 participants were included in the study. Fifteen of these individuals had moderate to severe physician diagnosed COPD, while nine were three to twelve months post MI. Each individual was monitored for seven 24-h periods. During each period, personal, indoor, and outdoor multi-pollutant concentrations were measured, with five individuals monitored simultaneously. Daily information on air exchange rates, time/activity patterns, and housing characteristics was also obtained. 24-h air exchange rates were measured using a constant release perfluorocarbon tracer (PFT) and capillary absorption tubes (CAT). During each monitoring day, participants also completed time/activity diaries, in which they recorded their activities in 15-minute intervals. Technicians administered a daily housing questionnaire each monitoring day to identify any specific activities that could influence particulate concentrations within the homes. Components of PM_{2.5} will be analyzed to determine the influence of specific sources upon personal, indoor and outdoor exposure patterns. Mixed effects models will be used to assess seasonal and individual specific variability. Analysis Preliminary results of the mixed models indicate that there is a significant difference between the fall and spring. Personal exposure to PM_{2.5} is more strongly associated with outdoor PM_{2.5} concentrations during the fall. Individuals with COPD show weaker associations between personal PM_{2.5} exposure with the corresponding outdoor concentrations than individuals who had a myocardial infarction. Further analysis of the effects of ventilation and time activity diaries will be presented along with other PM_{2.5} components. This work has been funded wholly by the United States Environmental Protection Agency under EPA Cooperative Agreement number (CR827159). It has been subjected to Agency review and approved for publication

Kissel, J.C., Showlund, R., Shirai, J.H., Suggs, J.C., and Cohen-Hubal, E.A. Investigation of transfer of fluorescent tracers from surfaces to skin. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Elaine A. Cohen-hubal

Abstract: Under the provisions of the Food Quality Protection Act (FQPA), aggregate exposure assessments must be conducted for pesticides proposed for registration. Many aspects of dermal exposure assessment remain poorly quantified. For purposes of assessing surface-to-skin transfers relevant to FQPA, a series of trials have been conducted using fluorescent tracers as surrogates for pesticides. In these trials, adult volunteers contacted surfaces loaded with tracers with their fingertips. Factors investigated included contact duration, contact pressure, surface tracer loading, surface type, contact scenario, skin moisture, and tracer aqueous solubility. Each variable was limited to two possible states. A hand press station (force plate) linked to a personal computer was utilized to control and record duration and pressure. Target conditions for those variables were 3 or 10 seconds and 30 or 100 g/cm². Initial average tracer surface loadings were 0.2 or 0.5 ?g/cm². Alternative surfaces were glass and a textured vinyl fabric. Contact was either static (press) or dynamic (swipe). Skin moisture on pre-moistened or dry fingers was assayed with a corneometer. One relatively hydrophilic and one relatively hydrophobic tracer were utilized. Digital images of both the fingers and the surfaces were captured under UV illumination before and after activity to attempt assessment of mass balance. Tracer loading vs. fluorescence calibration curves were produced for each individual volunteer to minimize potential effects of varying skin tones. Based on finger imaging, transfers of 0-1.5 ?g of tracer to roughly 2-3 cm² of finger surface were observed. Analysis of the relative importance of the experimental variables by multi-factorial anova is currently underway. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract no. 0D-5232-NTEX to the University of Washington. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Riley, W.J., McKone, T.E., and Cohen-Hubal, E.A. Linking dermal modeling and loading data to predict long-term doses from intermittent dermal contact. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Elaine A. Cohen-hubal

Abstract: In this paper we assess dermal exposure and dose resulting from intermittent contact with residue-contaminated surfaces. These estimates require an understanding of (1) the quantitative relationship between exposure and absorbed dose; (2) the impact of intermittent exposure on absorbed dose; and (3) the temporal resolution required of exposure data to model absorbed dose. We apply a numerical model of dermal absorption to evaluate integrated dermal uptake from a series of contacts with residue-contaminated surfaces. A range of exposure scenarios and contaminant properties are considered. We use results from dermal transfer studies in which dermal loading, resulting from a series of controlled contacts with surface residues, was measured using fluorescent imaging techniques. These experimental results allow us to define archetypal temporal boundary conditions with varying skin loading and removal (via rinsing and pressing). We apply these boundary conditions in a numerical model of contaminant transport through the stratum corneum (SC) and viable epidermis (VE). This model uses a Crank-Nicholson approach to solve the transient Fickian diffusion problem with an explicit approach to connect the SC and VE. We successfully tested the model against analytical solutions of single-contact exposure scenarios for a range of compound properties. The model allows us to investigate accumulated doses from short-term and intermittent contacts, thereby avoiding important limitations of analytical solutions. Our results indicate that increasing the partition coefficient between the SC and VE (ksv) decreases the time-integrated mass transferred through the VE as total contact time increases. This effect is caused by residual contaminant in the SC that reduces the concentration gradient (that drives transport from the skin surface into the SC) for subsequent contacts. Because of this ?residual effect,? multiple single-contact estimates cannot accurately capture integrated dose. The extent to which the single-contact estimate differed from the true dose varies with contaminant and skin properties. Below a ksv of about 0.1 the time-integrated mass transferred through the VE is relatively unaffected by changes in ksv, because the skin clears quickly with low ksv. We also describe the sensitivity of the time-integrated uptake (i.e., through the VE) to (1) the thickness and diffusivity of both the SC and the VE and (2) the contaminant-to-SC partition coefficient. Our results indicate that estimates of integrated dose resulting from a series of intermittent exposures can be practically obtained from the numerical model and related to compound properties. Results of this study can be used to guide dermal exposure model refinements and exposure measurement study design. This work has been funded wholly or in part by the United States Environmental Protection Agency under cooperative agreement no. No. DW-988-38190-01-0. It has been subjected to Agency review and approved for publication.

Vette, A.F., and Vallero, D.A. Environmental monitoring at Ground Zero and Lower Manhattan following the collapse of the WTC. Presented at: NCCU Seminar Class, Durham, NC, March 18, 2002.

3/18/2002

Contact: Alan F. Vette

Abstract: The U.S. EPA National Exposure Research Laboratory (NERL), in conjunction with our Regional offices, established a network of air monitoring sites to characterize ambient air concentrations of gases and particles in lower Manhattan following the collapse of the World Trade Center (WTC). Sites were monitored on a daily basis from September 21, 2001 through February, 2002. Integrated 24-h PM_{2.5} and continuous PM concentrations were measured at three ground-level sites within 100-200 m of the WTC (Ground Zero). The Ground Zero sites triangulated the WTC to characterize both upwind and downwind concentrations. A fourth monitoring site was located about 500 m from Ground Zero on the 16th floor of a building at 290 Broadway. Measurements at this site included integrated 24-hour PM_{2.5} and PM₁₀ concentrations as well as continuous PM and black carbon. The integrated PM_{2.5} and PM₁₀ aerosols collected at these sites were analyzed for mass concentrations as well as elemental composition using X-ray fluorescence (XRF). In early October, 2001 two additional sites were located about 500-1000 m from Ground Zero and equipped to measure airborne concentrations of 17 dioxin and furan congeners. Volatile organic compounds were collected in evacuated summa? canisters at 24-h and, later, at 72-h intervals for determination by capillary gas chromatography with flame ionization detection. Preliminary data and lessons learned in siting and operating monitoring sites following the attacks will be discussed. This work has been funded wholly or in part by the United States Environmental Protection Agency under contract #68-D-00-206 to Mantech International. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Alavanja, M., Samanic, C., Dosemeci, M., Lubin, J.H., Tarone, R., Lynch, C., Knott, C., Thomas, K.W., Hoppin, J.A., Barker, J., Coble, J., Sandler, D., and Blair, A. Use of agricultural pesticides and prostate cancer risk in the Agricultural Health Study Cohort. Presented at: International Conference on Pesticide Exposure and Health, Bethesda, MD, July 8-12, 2002.

7/8/2002

Contact: Kent W. Thomas

Abstract: The role of specific agricultural chemicals in relation to prostate cancer risk has not been firmly established due to the lack of precise exposure data. We examined the relationship between 45 common agricultural pesticides and prostate cancer incidence in a prospective cohort study of 55,332 male pesticide applicators from Iowa and North Carolina with no prior history of prostate cancer. Data were collected by means of self-administered questionnaires completed at enrollment (1993-1997). Cancer incidence was determined through population-based cancer registries from enrollment through December 31, 1999. A prostate cancer standardized incidence ratio (SIR) was computed as were odds ratios for individual pesticides and for pesticide use patterns identified through factor analysis. A prostate cancer SIR, 1.18 (95% CI, 1.09-1.28), was observed for the cohort. Factor analysis showed that the use of chlorinated pesticides among applicators over 50 years of age was significantly associated with prostate cancer risk ($p=0.005$). Significant interaction odds ratios were observed between specific pesticides (butylate, chlorpyrifos, coumaphos, fonofos, permethrin, phorate) a family history of prostate cancer and prostate cancer risk. Pesticide applicators have a small but significantly higher rate of prostate cancer than the general population. Findings for use of chlorinated pesticides, methyl bromide, and pesticide-family history interactions are novel and need to be confirmed. This work has been funded in part by the US EPA. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Thornburg, J., Rodes, C., Rodes, E., and Williams, R.W. Relationship between HVAC system operation, air exchange rate, and indoor-outdoor particulate matter ratios. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Ronald W. Williams

Abstract: Measurements of duty cycle, the fraction of time the heating and cooling (HVAC) system was operating, were made in each participant's home during the spring season of the RTP Particulate Matter Panel Study. A miniature temperature sensor/data logger combination placed on the return air vent monitored changes in temperature as the HVAC system cooled or heated the residence. The temperature data were compiled into a database, and the duty cycle assessed from step changes in temperature using a series of macros and subjective analyses. The duty cycle measurements will provide insight into the relationship between 24-hr integrated air exchange rate (AER) and indoor particulate matter concentrations. The mild climate conditions during the Spring season created large variability in the duty cycle data due to the large number of days the HVAC did not operate or operated in both heating and cooling modes. The group average HVAC duty cycle was 0.061 (operational only 6.1% of the time) with a standard deviation of 0.054. The median number of days the HVAC system operated during a sampling week was 2.5 days, and the maximum and minimum 24-hr duty cycles were 45% and 0%, respectively. Almost 31% of the participants kept their HVAC off 6 or more days during their 7 days of sampling. A significant relationship between the 24-hr duty cycle means and air exchange rates existed only if the HVAC system operated for 6 or more days per week and the range in the 24-hr duty cycles exceeded 0.10. In those cases, an increase in duty cycle caused an increase in the 24-hr average duty cycle. The magnitude of the increase depended on the outdoor-indoor temperature differential. The duty cycle correlated with 24-hr indoor-outdoor particulate matter ratios only if there was a significant relationship between duty cycle-AER and there were not any strong indoor particle sources. The usefulness of the duty cycle data in interpreting particulate matter indoor-outdoor ratios would be improved if HVAC system particle removal efficiency, air flow recirculation rates, and integrity (leak assessments) were characterized in detail for both heating and cooling mode. Also, the infrequency of HVAC system use during the mild Spring and Fall "transition" seasons limited the effect on the indoor particle concentrations. However, the HVAC system should have a larger influence on indoor particle concentrations in Winter (heating) and Summer (cooling) seasons when the system operates more than 10% of the time. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D5-0040 and 68-D-99-012 to RTI. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Anderson, Y.B., Vallero, D.A., and Leovic, K.W. Innovative approaches to human exposure assessment in environmental justice communities. Presented at: Environmental Science & Technology Conference, Winston-Salem, NC, September 8-10, 2002.

9/8/2002

Contact: Kelly W. Leovic

Abstract: North Carolina Central University (NCCU) recently began an innovative human exposure research program in collaboration with the U.S. Environmental Protection Agency's National Exposure Research Laboratory in Research Triangle Park, NC. In this project, researchers will examine potential routes of environmental exposure by measuring contaminants in selected communities. The project will also serve to develop the research infrastructure of the NCCU Environmental Science Program and outreach tools for environmental justice communities.

The project will begin by assessing the environmental exposures in one community of color and/or economically disadvantaged that may be impacted by environmental hazards. A long-range goal of the project is to develop and validate community-level exposure scenarios that can be adapted to other similar communities of color and/or economically disadvantaged communities. The community to be studied will be an environmental justice community, have a sufficient data set available to establish a baseline of exposure scenarios, have existing community groups or structures to help to provide input and feedback to the researchers, and have sufficient population for recruitment of study participants. In addition, it would be desirable for the community to be representative of larger North Carolina socioeconomic and racial demographics, provide for state and local partnerships, be a continuous and ongoing exposure scenario (rather than a single or episodic event), maximize NCCU faculty and student involvement, and have reasonable cost-effective sampling and analytical approaches.

The status of the study design and the possible "lessons learned" and opportunities for technology transfer to other environmental justice communities will be discussed. This work has been funded wholly or in part by the United States Environmental Protection Agency under cooperative agreement # R-82946901-0. It has been subjected to Agency review and approved for publication.

Cohen-Hubal, E.A. Issues in understanding dermal exposures resulting from contact with contaminated surfaces, measuring surface contamination, and characterizing transfers. Presented at: International Conference on Occupational and Environmental Exposures of the Skin, Arlington, VA, September 8-11, 2002.

9/8/2002

Contact: Elaine A. Cohen-hubal

Abstract: Although monitoring for surface contamination in work with radioactive materials and dermal monitoring of pesticide exposure to agricultural workers have been standard practice for 50 years, regular surface sampling and dermal monitoring methods have only been applied to industrial and residential contamination since the 1980s. In recent years, there have been significant advances in the tools available to measure and assess dermal exposures resulting from contacts with contaminated surfaces. However, there are still important gaps in our understanding of the determinants of this type of dermal exposure and how best to measure and assess the exposure. To identify the major uncertainties associated with quantifying dermal exposures resulting from contact with contaminated surfaces it is useful to consider the pathways and mechanisms for these exposures. Transfer of contaminants from a contaminated surface to the skin is a function of: (1) the form of the contamination (residue, particle, formulation, age, physicochemical properties); (2) characteristics of the surface (hard, plush, porous, surface loading, previous transfer); (3) characteristics of the skin (moisture, age, loading, previous transfer); (4) contact mechanics (pressure, duration, smudge, repetition); and (5) environmental conditions (temperature, relative humidity, air exchange). In addition, human behaviors in both occupational and non-occupational settings represent an important determinant of exposure that adds significant variability to estimates of dermal exposure. In this presentation, important data gaps associated with the mechanisms of transfer from contaminated surfaces will be identified. In addition, our current approaches for characterizing and assessing dermal exposure resulting from contact with contaminated surfaces in both residential and occupational environments, as well as the research needed to move the state-of-the-science forward, will be considered. This work has been funded by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Williams, R.W., Rea, A.W., Suggs, J.C., Leovic, K.W., Vette, A.F., Croghan, C., Sheldon, L.S., Rodes, C., Thornburg, J., Ejire, A., and Sanders, Jr., W. A comparison of environmental exposures to selected air pollutants between two apparent socio-economically diverse populations in the Research Triangle Park metropolitan area. Presented at: 2002 NC Environmental Justice Summit, Durham, NC, October 18-19, 2002.

10/18/2002

Contact: Ronald W. Williams

Abstract: Human exposures to certain size fractions of ambient air Particulate Matter (PM) have been related to apparent associations in increased mortality and morbidity in the U.S. population. This risk association would appear to be relevant to the general population and even more pronounced for those at highest risk (e.g., the elderly, cardiovascular and pulmonary impaired). The U.S. Environmental Protection Agency has recently completed a one-year investigation of personal, residential and ambient particulate matter (PM) mass concentrations in two potentially susceptible subpopulations living within the Research Triangle Park Metropolitan Area. One purpose of this study was to define the degree to which individuals are exposed to PM and the variability of this exposure. A total of 35 individuals participated. The first group consisted of 8 individuals having implanted cardiac defibrillators living in and near Chapel Hill, NC. The second group consisted of 27 African-Americans with controlled hypertension and living in a HUD-defined low/moderate socio-economic-status neighborhood in southeast Raleigh, NC. All of the study participants were at least 50 years of age, non-smokers, and lived independently in their own residence. Study volunteers participated in the study a total of 28 days over the course of one year (7 days each season). Results will be presented that defines the level of PM exposure between each group and the role of human activities (lifestyle) as one factor in influencing an individual's total personal PM exposure.

This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-99-012 to the Research Triangle Institute and assistance agreement #CR-828186-01-0 to Shaw University. It has been subjected to Agency review and approved for publication.

Egeghy, P.P. Mixed models analysis of urbanization level on chlorpyrifos exposure. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: James J. Quackenboss

Abstract: The National Human Exposure Assessment Survey (NHEXAS) pilot studies were conducted from 1995 through 1997 to examine human population exposure to a wide range of environmental contaminants. In one of the studies, NHEXAS-Maryland, a longitudinal design was used to repeatedly measure aggregate residential chlorpyrifos exposure in a stratified random sample of 80 individuals. Chlorpyrifos is a semi-volatile insecticide which has been found to persist for weeks following application. Until its recent removal from the retail market, chlorpyrifos was commonly used for indoor and outdoor treatments by both residents and commercial applicators and also as a termiticide during residential construction. The effect of urbanization level (i.e., characterization of participant's community as urban, suburban, or rural) on chlorpyrifos exposure was investigated using mixed-effects regression models to accommodate longitudinal data and to estimate variance components. Three surrogates of exposure, namely, indoor air concentrations ($n = 97$), surface dust loading ($n = 123$), and creatinine-adjusted urinary metabolite (3,5,6-trichloro-2-pyridinol) concentrations ($n = 341$), were considered separately. The effect of the specified covariance structure was explicitly evaluated to determine if the pooling of variance components, as is often performed by default, is appropriate. Likelihood ratio tests comparing possible covariance structures suggested that the pooling of within- and between-person variance components among urbanization levels may not be appropriate for indoor air concentrations ($p < 0.001$). The variance estimates indicated that indoor air concentrations were far more variable among households in rural communities than in urban or suburban communities. Furthermore, since maximum likelihood estimates of the means depend upon the variance components, the choice of covariance structure exerted a large effect upon the estimates of indoor chlorpyrifos concentrations. Mean indoor air concentrations for urban, suburban, and rural households in this study were estimated to be 7.3, 20.2, and 23.0 $\mu\text{g}/\text{m}^3$, respectively, when allowing for distinct variance components, but were estimated to be 11.9, 16.6, and 11.7 $\mu\text{g}/\text{m}^3$, respectively, when pooling the components. Similar analyses, on the other hand, indicated that variance components may be pooled among urbanization levels when evaluating surface dust and urinary metabolite concentrations. These preliminary results, albeit based on relatively small sample sizes, indicate that the choice of covariance structure can have a large effect on the results of an analysis and must be given appropriate consideration. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Ramanathan, K., Apostol, A.B., Rogers, K.R., and Gary, R. A fluorescence based assay for DNA damage: induced by radiation, chemicals and enzymes. Presented at: American Chemical Society, Orlando, FL, April 7-11, 2002.

4/7/2002

Contact: Kumaran Ramanathan

Abstract: A simple and rapid assay to detect DNA damage is reported. This assay is based on the ability of certain dyes to fluoresce upon intercalation with dsDNA. Damage caused by ultraviolet (UV) radiation, chemicals or restriction enzymes is detected using this assay. UV radiation at 254 nm approximating UV-C and radiation at 360 nm approximating UV-A, were used to induce the damage in plasmid dsDNA (pUC19). Chemical damage was induced using several compound classes with known effects on nucleic acids. Restriction enzymes hind III, msp1, sau 3A1 were used to cut the plasmid at specific sequences in addition to the nonspecific endonuclease DNAase I. The effect of these types of damages on repeated melting and annealing of dsDNA were observed in real time using several fluorescence indicator dyes. The assay response for dsDNA between 10 and 100 ng/mL was linear with a detection limit of 20 pg and a coefficient of variation of 2% (CV%). The assay was also optimized to study the efficiency of various sun blocking agents against DNA damage. The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), funded this research and approved this abstract as a basis for an oral presentation. The actual presentation has not been peer reviewed by EPA.

Mishra, N.N., Rogers, K.R., and Wang, J. Chromium electroanalysis at screen printed electrode modified by thin films of nickel. Presented at: American Chemical Society, Orlando, FL, April 7-11, 2002.

4/7/2002

Contact: Kim R. Rogers

Abstract: A rapid and potentially cost-effective electrochemical method is reported for analysis of chromium (VI) and Chromium(III) using a nickel modified screen printed carbon ink electrode. Electrochemical characteristics of nickel modified electrode as well voltammetric behavior for chromium with electrolyte and non electrolyte media are discussed. Scanning electron micrographs and elemental analysis of nickel film yield an indication of the structural features of the electrode surface. The nickel electrode responds well to both Chromium (VI) and Chromium(III) over the concentration range of 0.1 ppb 10 ppb. This method is also proposed to analyze cadmium, copper and lead in environmental samples. One advantage of this method is that the nickel electrode is sensitive, stable and environmentally friendly compared to mercury film electrodes which are typically used for chromium analysis. The potential development of this method for field analysis is also discussed. The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), funded this research and approved this abstract as a basis for an oral presentation. The actual presentation has not been peer reviewed by EPA.

Robertson, G.L. Environmental chemical monitoring in the U.S.. Presented at: Passive Monitoring Symposia, London, UK, September 23-28, 2002.

9/23/2002

Contact: Gary L. Robertson

Abstract: Chemical monitoring of the environment is performed in the United States by Federal and State agencies, local governments, industries, organizations, and private individuals. The major reasons for monitoring are for compliance with laws and regulations, investigation of suspected environmental contamination, and general concerns for the protection of human health and the environment. An overview of the chemical monitoring performed by the above entities will be presented. The role of the U. S. EPA in environmental chemical monitoring will be discussed. This will include the Regional and Program Office responsibilities and activities and how the Office of Research and Development (ORD) is involved. General areas of current ORD research will be covered and examples will be given of current research projects involving passive sampling devices. This work has been funded wholly or in part by the United States Environmental Protection Agency and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Furtaw, Jr., E.J. Overview of the U.S. EPA NERL's Human Exposure Modeling. Presented at: Theories and Practices in Toxicology and Risk Assessment, Cincinnati, OH, April 15-18, 2002.

4/15/2002

Contact: Edwin J. Furtaw

Abstract: Computational modeling of human exposure to environmental pollutants is one of the primary activities of the US Environmental Protection Agency's National Exposure Research Laboratory (NERL). Assessment of human exposures is a critical part of the overall risk assessment paradigm. In exposure assessment, we analyze the source-to-effects sequence of processes, in which pollutants are released from sources into the environment, where they may move through multiple environmental media, and to human receptors via multiple pathways. Exposure occurs at the environment-human interface, when pollutants are contacted in the course of human activities. Exposure may result in dose, in which chemicals enter the body through multiple portals of entry, primarily inhalation, ingestion, and dermal absorption. Within the body, absorbed pollutants are distributed to, metabolized within, and eliminated from various organs and tissues, where they may cause toxicologic responses or adverse health effects. NERL's modeling efforts are directed at improving our understanding of this sequence of processes, by characterizing the various factors influencing exposures and dose, and their associated variabilities and uncertainties. Modeling at NERL is one of three essential programmatic elements, along with Measurements and Methods Development. These are pursued interactively to advance our understanding of exposure-related processes. Exposure models are developed and run using the best currently available measurement data to simulate and predict population exposure and dose distributions, and to identify the most important factors and their variabilities and uncertainties. This knowledge is then used to guide the development of improved methods and measurements needed to obtain better data to improve the assessment and reduce critical uncertainties. These models and measurement results are tools that can be used in risk assessments and in risk management decisions in order to reduce harmful exposures. Current areas of NERL's exposure modeling emphasis include: Pollutant concentrations in ambient (outdoor) air using the Third Generation Air Quality Modeling System's Community Multiscale Air Quality model (Models-3/CMAQ); Air flow and pollutant concentrations at local and microenvironmental scales using computational fluid dynamics (CFD); Human inhalation exposure to airborne particulate matter, air toxics, and multi-pathway exposure to pesticides, using the Stochastic Human Exposure and Dose Simulation (SHEDS) model; Human and ecological exposure and risk assessments of hazardous waste sites using FRAMES-3MRA (Framework for Risk Analysis in Multi-media Environmental Systems-Multi-media, Multi-pathway, Multi-receptor Risk Assessment), one of many software programs available from NERL's Center for Exposure Assessment Modeling (CEAM); Physiologically based pharmacokinetic modeling of pesticides and volatile organic compounds in the Exposure Related Dose Estimating Model (ERDEM). A brief historical overview of NERL's evolution of human exposure models will be presented, with examples of the present state-of-the-science represented by SHEDS and FRAMES-3MRA. This is an abstract of a proposed presentation and does not necessarily reflect the United States Environmental Protection Agency (EPA) policy. The actual presentation has not been peer reviewed by EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Rigas, M.L., Okino, M.S., and Quackenboss, J.J. Pharmacokinetic models in the design of biomonitoring programs. Presented at: International Society of Exposure Analysis 2002 Conference, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Marc L. Rigas

Abstract: Measurements of chemicals in tissues, blood, or urine can be related to health effects because they are an integrated measure of absorbed dose following exposure. However, the direct relationship between biomonitoring data and pathway-specific exposures is more tenuous. In chemical exposure studies biomonitoring is used as a surrogate for total exposure, but there is frequently debate regarding how often samples must be collected to adequately characterize exposure. Pharmacokinetic (PK) models are mathematical representations of, at minimum, absorption and clearance and can be used to estimate internal dose based on multi-route exposure. The reverse calculation to extract a unique exposure profile from biomonitoring data is not possible. However, pharmacokinetic modeling can be used to aid in the design of appropriate biomonitoring strategies for field studies. We used data from a previously published study of worker exposure to 2,4-dichlorophenoxyacetic acid (2,4-D). In this study, researchers collected 7 total urine samples per worker for several days following an occupational exposure. By evaluating the properties of a PK model we determine the optimal times to collect urine during the post-exposure period. By mathematically minimizing the uncertainty in the model output and setting urine sampling at the times of minimum uncertainty, we find that it is possible to estimate exposure sufficiently utilizing as few as 3 total urine collections. As a result, cost and participant burden can be reduced. This work has been funded by the U.S. Environmental Protection Agency through efforts of its Office of Research and Development. It has been subjected to Agency review and approved for publication but does not necessarily reflect policy or view of the Agency.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Scheffe, R., Solomon, P.A., Jones, M., and Pitchford, M. Overview and status of the PM supersites program. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Paul A. Solomon

Abstract:

Dary, C.C., Furtaw, Jr., E.J., Power, F.W., and Blancato, J.N. Physiologically-based pharmacokinetic and pharmacodynamic (PBPK/PD) model for predicting the dermal dose and disposition of organophosphorus insecticides. Presented at: Society for Risk Analysis Meeting, New Orleans, LA, December 8-11, 2002.

12/8/2002

Contact: Curtis C. Dary

Abstract: Physiologically-based pharmacokinetic/ pharmacodynamic (PBPK/PD) models are particularly suited for interpretation of cumulative risk via the dermal route for which aggregate exposure must be assessed for chemicals having a common mechanism of toxicity. To this end, a quantitative structure-activity relationship (QSAR) database was compiled containing physicochemical descriptors and percutaneous absorption, pharmacokinetic, and metabolic parameter estimates, for 31 organophosphorus (OP) insecticides. The QSAR descriptors were obtained using molecular modeling software (HyperChem? ChemPlus?). Pharmacokinetic, metabolic, and percutaneous absorption parameter estimates were obtained from the published literature. Results indicate that QSAR techniques can provide reasonable estimates of pharmacokinetic, metabolic, and skin absorption parameter values for individual OP insecticides and mixtures for use in cumulative risk assessment. This approach holds great promise for advancing our understanding of a dynamic source-to-exposure-to-dose process involving aggregate exposure of infants and children to a broad range of organophosphorus (OP) insecticides with differing chemical structures. These dermal parameters were used in the Exposure Related Dose Estimating Model (a PBPK/PD model) to determine the relevant dose for exposure of children to OP insecticides, parathion, chlorpyrifos, and isofenphos. The U.S. EPA Office of Research and Development funded this research. The abstract was reviewed and approved. The oral presentation has not been reviewed. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Furtaw, Jr., E.J., Bennett, D.H., and McKone, T.E. An indoor pesticide air and surface concentration model. Presented at: 12th Conference of the International Society of Exposure Analysis, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Edwin J. Furtaw

Abstract: A thorough assessment of human exposure to environmental chemicals requires consideration of all processes in the sequence from source to dose. For assessment of exposure to pesticides following their use indoors, data and models are needed to estimate pesticide concentrations in air, and loadings (surface concentrations) on a variety of surfaces which humans contact. The objective of the current project is to develop such a model. This model will be used to assist in the assessment of inhalation, dermal, and non-dietary ingestion pathways, which are potentially significant for exposure to pesticides used in residences. A limited amount of data has been collected on pesticide concentrations in various residential compartments following an application. Models are needed to interpret these data and make predictions about other scenarios and other pesticides based on chemical properties. In this presentation, we describe a mass-balance compartmental model with several parameter values derived from fugacity principles. The model simulates pesticide air concentrations and surface loadings following the use of an indoor source, i.e. the application of a pesticide to partial surfaces, such as would occur in a crack-and-crevice application. We include air (both gas phase and aerosols), carpet, smooth flooring, and walls as model compartments. We estimate the compartmental fugacity capacities and mass-transfer rate coefficients for several types of materials commonly found in residences. We also describe the framework and equations for a multi-compartment dynamic mass-balance model, and show model outputs compared to measured pesticide air concentrations and surface loadings as functions of time following a pesticide application. This is an abstract of a proposed presentation and does not necessarily reflect the United States Environmental Protection Agency (EPA) policy. The actual presentation has not been peer reviewed by EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Hutzell, W.T. A regional model for PCDD/F's based on a photochemical model for air quality and particulate matter. Presented at: AGU Fall Meeting, San Francisco, CA, December 6-10, 2002.

12/6/2002

Contact: William T. Hutzell

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

Lewtas, J., Meyers, S., Maykut, N., Simpson, C., Kalman, D., Liu, L.-J.S., and Larson, T.V.
Attribution of particle exposure and risk to combustion source emissions based on personal PAH exposure and urinary metabolites. Presented at: International Society of Exposure Analysis, Vancouver, Canada, August 11-15, 2002.

8/11/2002

Contact: Joellen lewtas Jungers

Abstract: Personal airborne exposures to carcinogenic particulate PAH have been significantly correlated with exposure to respirable fine particle mass (PM 2.5) in several studies. All combustion sources emit PAH, however the relative concentrations of different PAH and other organic tracers (source profiles) vary by source category. The underlying hypothesis of this study is that PAH profiles of personal exposure and urinary PAH metabolites are tracers of exposure to different sources of combustion particles. The study objective was to determine the relative contribution of combustion sources to a population through application of positive matrix factorization (PMF) to personal exposure and urinary metabolite data. This approach does not rely on pre-determined source profiles. PMF, was applied to multiple measures of personal exposure including particulate PAH and urinary PAH metabolites. Other measures of personal exposure (e.g., cotinine and blood metals) and metabolic susceptibility (metabolic genotype) were also considered. Personal air filters (PM2.5) were collected for the 24 hours. Urine was collected as a morning void after 24h sampling (Czech Study) or during sampling (Seattle). The personal air filters and urine extracts were analyzed for organic tracers using both HPLC and GC/MS. The urine was treated by enzymatic hydrolysis using b-glucuronidase and arylsulfatase prior to analysis. Data from two human exposure studies were used in this initial analysis including two populations in the Czech Republic where the dominant exposure sources included coal combustion and three susceptible populations in Seattle, WA where the dominant combustion sources included motor vehicles and vegetative burning. Potential source tracers and their metabolites included benzo(ghi)perylene (BghiP), identified as a source tracer for gasoline engine exhaust, methylated PAH associated with coal combustion, the nicotine metabolite, cotinine, as a marker of exposure to tobacco smoke, and specific vegetative burning metabolites (e.g., methoxyphenols) as well as metabolites of the more carcinogenic PAH, such as benzo(a)pyrene (BaP). Initial PMF factor analysis using personal PAH exposure, urine metabolites and blood metals in the Czech population identified three sources of exposure including coal related outdoor air, an indoor tobacco source, and a possible dietary source related to blood metals. Recent PMF analysis of outdoor air measurements in Seattle (1996-1999) resulted in identifying eight sources of PM2.5. Vegetative burning (33.8%), diesel (14.5%), and gasoline vehicles (5.4%) accounted for 54% of the PM2.5. Previous studies linking the outdoor apportionment of combustion sources with the relative tumor-initiating potency of motor vehicle emissions and wood stove (vegetative) burning emissions resulted in a higher relative risk from the motor vehicle emissions. This work has been funded by the U S Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Isaacs, K.K., Evans, MV, and Harris, T.R. Visualization-based analysis for a mixed-inhibition binary PBPK model: determination of inhibition mechanism. Presented at: Fifth Tennessee Conference on Biomedical Engineering, Memphis, TN, April 4-6, 2002.

4/4/2002

Contact: Marina V. Evans

Abstract: Introduction A physiologically-based pharmacokinetic (PBPK) model incorporating mixed enzyme inhibition was used to determine mechanism of the metabolic interactions occurring during simultaneous inhalation exposures to the organic solvents chloroform and trichloroethylene (TCE). Methods Visualization-based sensitivity and identifiability analyses of the PBPK model were performed to determine the conditions under which four inhibitory constants (describing enzyme-inhibitor enzyme/substrate complex-inhibitor interactions) could be estimated. The sensitivities of the model output parameters to all four inhibitory constants were visualized at many parameter space points for several sets of experimental conditions. The local identifiability of the parameters was also analyzed at many parameter space points by testing the parameter sensitivities for linear dependence. Results and Discussion The sensitivity analysis predicted ideal experimental conditions for estimation of the inhibitory parameters. The inhibitory constants were graphically determined from multiple closed-chamber gas-uptake experiments performed on rats under these optimal conditions. The estimated values of the four inhibitory constants predicted that chloroform and TCE interact in a purely competitive manner. Conclusions Based on our model analysis, we present recommendations for the design of future experiments for determination of inhibition mechanism in binary chemical mixtures. We assert that a thorough analysis of the parameter-dependent sensitivity and identifiability characteristics can be used to plan efficient experimental protocols for the quantitative analysis of inhalation pharmacokinetics. This work has been funded (wholly) or (in part) by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Lewtas, J., Maykut, N., Kim, E., and Larson, T. Improving source profiles and apportionment of combustion sources using thermal carbon fractions in multivariate receptor models. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Joellen lewtas Jungers

Abstract: The purpose of this study was to improve combustion source profiles and apportionment of a PM2.5 urban aerosol by using 7 individual organic and elemental carbon thermal fractions in place of total organic and elemental carbon. This study used 3 years (96-99) of speciated data from 289 sets of PM2.5 filters (Teflon, nylon and quartz) collected at the Seattle Beacon Hill monitoring site using the IMPROVE protocol. Particulate carbon was analyzed on quartz filters using the thermal optical reflectance (TOR) method that divides the organic carbon (OC) into four fractions (OC1-OC4) and three elemental carbon (EC) fractions (EC1-EC3). The relatively new multivariate receptor models used in this study were Positive Matrix Factorization (PMF) and UNMIX. These two models are used to derive source profiles from the ambient data as well as for source apportionment. The total PM2.5 measurements used in the analysis included mass, 7 carbon fractions, 20 trace elements determined by two X-ray methods, anions (sulfate, nitrate, chloride) by ion chromatography, and elemental hydrogen (H) by proton scattering. The PMF model was able to utilize all of the data (30 species) to derive 8 source profiles. The sources with the highest contribution of the most abundant carbon fractions (OC1-OC4 and EC1), all appear to be combustion sources. We have designated those as gasoline/motor vehicles, diesel emissions, vegetative burning, and fuel oil based on the source profiles from the PMF model. The following elements are found in relatively high abundance for each of these sources: OC3, Pb, Zn, and Ti in the gasoline profile; EC1, Fe, Zn, Si, Ca, and Mn in the diesel profile; OC3, OC4, EC1, OC2, and K in the vegetative burning profile; and OC4, Ni, and V in the fuel oil profile. The other 4 profiles derived from the PMF model have been designated as follows with distinguishing elements indicated in parentheses: soil (Si, Al, Ti), marine (Na, Cl), Na rich (nitrate, Na, E2, Ca, K, E3), and sulfate source (sulfate, nitrate, E1). UNMIX was more restrictive in deriving 6 source profiles based on a statistically acceptable model solution using 15 out of the 30 available species including OC2, OC3, OC4 and EC1 but not OC1 or EC2. Both of these receptor models derived source profiles for 4 different combustion sources containing OC fractions and EC1 whose abundances differ between the sources. Both models derived a profile for soil (Si and Al) and marine/sulfate source(s) (sulfate, Ca, and K). The marine and sodium rich source(s) containing EC1/EC2 fractions may contain some marine diesel combustion emissions. Both of these multivariate models generally agree in the estimated relative source contributions of the combustion sources to the PM2.5 mass as follows: vegetative burning (28-37%), diesel (18-19%), fuel oil (10-15%), gasoline (4-9%). Previously, we reported the analysis of this data by the Chemical Mass Balance model (CMB8) using total OC and EC. The CMB8 distinguished only two major combustion sources, vegetative burning and mobile sources. This work has been funded by the U S Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Schantz, M.A., Wise, S., and Lewtas, J. Interlaboratory comparison studies for characterization of organic compounds in particulate matter. Presented at: American Association for Aerosol Research, Charlotte, NC, October 7-11, 2002.

10/7/2002

Contact: Joellen lewtas Jungers

Abstract: A working group of investigators, who are characterizing and quantifying the organic compounds in particulate matter (PM) as part of the US EPA's PM 2.5 research program and related studies, was established three years ago to advance the quality and comparability of data on the organic composition of PM. This group has just completed their second interlaboratory comparison study. The first study used a subset of SRM 1649a (Urban Dust, sieved to <123 μ m) that had been sieved to <63 μ m (Air Particulate I) as an unknown PM sample. In addition to Air Particulate I, the participants received a dichloromethane extract of Air Particulate I as a second unknown sample and a sample of SRM 1649a for use as a control material. For the second study, initiated in March 2002, the participants received a sample of PM_{2.5} collected recently in Baltimore, MD along with a sample of SRM 1649a. It is a requirement that all participants return data on Air Particulate I and SRM 1649a prior to receiving the Baltimore PM_{2.5} material, so at this point there are participants at different stages of the two studies. To date 11 laboratories have received samples for the first study and 13 laboratories have received samples for the second study. The target analytes include polycyclic aromatic hydrocarbons (PAHs), nitrated PAHs, alkanes (including hopanes and cholestanes), sterols, carbonyl compounds (ketones and aldehydes), acids (alkanoic and resin), phenols, and sugars. Because this is a performance-based study, laboratories are encouraged to use the methods that they are routinely using in their laboratories to analyze similar samples. Laboratories are requested to return data from three analyses (subsamples) of each sample provided along with a summary of the methods used. The data received from the participating laboratories, following outlier testing, are then used to assign a consensus value to each analyte in the unknown samples. Results are used in the consensus value assignment for the unknown PM sample only if the laboratory's results for SRM 1649a are within 30% of the uncertainty limits of the certified values. The consensus values, accuracy and precision assessments, and the methods used by each laboratory are summarized in a report provided to the participants. In this report, laboratories are numerically identified with only the laboratory and the exercise coordinators knowing this numerical identification. A meeting of the participants is also held to discuss the results and the methods used by the laboratories. The results from the two interlaboratory exercises will be presented along with plans for future exercises. This work has been funded by the U S Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Lewtas, J., Maykut, N., Kim, E., and Larson, T. Source apportionment of PM_{2.5} in Seattle, WA urban improve site: comparison of three receptor models and source profiles. Presented at: 2003 AAAR PM Meeting, Pittsburgh, PA, March 31-April 4, 2003.

3/31/2002

Contact: Joellen lewtas Jungers

Abstract: IMPROVE protocol data were collected at the urban Beacon Hill monitoring site in Seattle, WA from 1996-99. The 289 sets of PM_{2.5} filters were analyzed for: metals using PIXIE and XRF, anions using ion chromatography, elemental hydrogen (H) by proton scattering, and elemental and organic carbon fractions (OC1-OC4 and EC1-EC3) by thermal optical reflectance (TOR). The data was analyzed by CMB8, Positive Matrix Factorization (PMF) and UNMIX. The CMB8 model determined the contribution of minor industrial sources (7%), two combustion sources, vegetative burning (16%) and mobile sources (44%), soil (4%), and 3 marine and secondary sources. The PMF model was able to utilize all of the data (30 species) to derive 8 sources. The sources with the highest contribution of the 5 most abundant carbon fractions (OC1-OC4 and EC1), all appear to be combustion sources. We have designated those as gasoline vehicles, diesel, vegetative burning, and fuel oil based on the profiles derived from the PMF model. The following components are found in relatively high abundance for each of these sources: OC3, Pb, Zn, K, and Ti in the gasoline profile; EC1, Fe, Zn, and Mn in the diesel profile; OC3, OC4, EC1, OC2, and K in the vegetative burning profile; OC4 and V in the fuel oil profile. The other 4 profiles derived from the PMF model we have designated as follows with the distinguishing elements indicated in parentheses: soil (Si, Al, Ti), marine (Na, Cl), Na rich (nitrate, Na, and both OC and EC fractions, Ca, and K), and a sulfate (secondary) source (sulfate, nitrate, and EC1). UNMIX was more restrictive in deriving 6 sources based on a statistically acceptable model solution using 15 out of the 30 available species including OC2, OC3, OC4 and EC1 but not OC1 or EC2. Both of these receptor models derived source profiles for 4 different combustion sources containing OC fractions and EC1 whose abundance differ between the sources. Both models derived a profile for soil (Si and Al) and marine/sulfate source(s) (sulfate, Ca, and K). The marine and sodium rich source(s) containing EC1/EC2 fractions may contain some marine diesel combustion emissions. Both of these multivariate models agree in the estimated relative contributions of the combustion sources to the PM_{2.5} mass as follows: vegetative (28-37%), diesel (18-19%), fuel oil (10-15%), gasoline (4-9%). This work has been funded by the U S Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Lindstrom, A.B., and Pleil, J.D. Exhaled breath analysis and exposure assessment research. Presented at: NCCU Environmental Science Seminar, Durham, NC, November 5, 2002.

11/5/2002

Contact: Andrew B. Lindstrom

Abstract:

Bradham, K., Basta, N., Lano, R., Schroder, J., and Payton, M. Effect of soil properties on the toxicity and bioavailability of metals. Presented at: 7th International Conference on the Biogeochemistry of Trace Elements, Uppsala, Sweden, June 15-19, 2003.

6/15/2002

Contact: Karen D. Bradham

Abstract:

Heavy metal and organic chemical contamination of soils is a worldwide problem posing a risk to humans and more directly, soil organisms. Due to widespread metal contamination, it is necessary to characterize soils suspected of metal contamination and determine if the metal levels in these soils pose a hazard. Peer-reviewed, ecologically based soil screening levels (Eco-SSLs) are currently being developed in the U.S. to protect ecological receptors from the toxic effects of heavy metals and organic contaminants. Eco-SSLs are measures of chemicals in soil, which are believed to pose little or no risk to ecological receptors. If site measurements of chemicals are compared to Eco-SSLs and found to be lower, then these sites can be removed from further evaluation in the ecological risk assessment process. Metal toxicity is often not directly related to the total concentration of metals present due to a number of modifying factors that depend, in part, on soil chemical properties. Soil organic matter, pH, and clay content are soil chemical properties that influence metal toxicity and bioavailability. Risk is directly related to metal bioavailability, which depends upon metal concentration, the geochemical forms of metal, the species of organism exposed, physical and chemical characteristics of the exposure environment, and the exposure duration. In order to understand metal bioavailability in soils, chemical and biological techniques are needed to measure the portion of metal that is theoretically bioavailable to soil organisms. These can range from direct measures of bioavailability such as internal concentrations to indirect measures such as chemical extractions. The primary objective of this research was to examine the interaction between different combinations of soil modifying factors (pH, organic matter content, clay content) on metal bioavailability to provide data useful for the development of Eco-SSLs and for reducing uncertainty associated with the determination of site-specific ecological risks. The research in this manuscript has been funded by the U.S. Environmental Protection Agency, Office of Research and Development, National Center for Exposure Assessment. Although the research described in this paper has been funded by the U.S. EPA to Dr. Roman Lanno and Dr. Nicholas Basta of Oklahoma State University, it has not been subjected to the Agency's required peer and policy review and therefore does not necessarily reflect the views of the Agency and no official endorsement should be inferred.

Zartarian, V., Xue, J., Ozkaynak, H., Glenn, G., Stallings, C., Smith, L., Dang, W., Cook, N., Aviado, D., Mostaghimi, S., and Chen, J. Modeling exposure and dose of children to wood treatment preservatives from playsets and home decks. Presented at: Society for Risk Analysis Conference, New Orleans, LA, December 8-11, 2002.

12/8/2002

Contact: Curtis M. Morris

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

Vette, A.F., Landis, M.S., Williams, R.W., LaPosta, D., Kantz, M., Filippelli, J., Webb, L., Ellestad, T.G., and Vallero, D.A. Concentrations and speciation of PM at Ground Zero and Lower Manhattan following the collapse of the WTC. Presented at: Environmental Science Seminar, Durham, NC, September 17, 2002. 9/17/2002

Contact: Curtis M. Morris

Abstract: The U.S. EPA National Exposure Research Laboratory (NERL), in conjunction with our Regional offices, established a network of air monitoring sites to characterize ambient air concentrations of gases and particles in lower Manhattan following the collapse of the World Trade Center (WTC). Monitoring at these sites was conducted on a daily basis from September 21, 2001 through February, 2002. Integrated 24-hour PM_{2.5} concentrations and continuous measurements of PM concentrations were made at three ground-level sites within 100-200 m of the WTC (Ground Zero). The Ground Zero sites triangulated the WTC in order to characterize both upwind and downwind concentrations. Another monitoring site was located about 500 m from Ground Zero on the 16th floor of a building at 290 Broadway. Measurements at this site included integrated 24-hour PM_{2.5} and PM₁₀ concentrations as well as continuous PM and black carbon concentrations. The integrated PM_{2.5} and PM₁₀ aerosols collected at these sites were analyzed for mass concentrations as well as elemental composition using X-ray fluorescence (XRF). In early October, 2001 two additional sites located about 500-1000 m from Ground Zero were equipped to measure airborne concentrations of 17 dioxin and furan congeners. Concentrations of PM_{2.5} surrounding Ground Zero were elevated and highly variable through late October, 2001. In general, concentrations of PM_{2.5} during this period were highest at the Ground Zero site located north of the WTC (96 ± 85 ug/m³; mean ± SD) and lowest at the southeast site (36 ± 18 ug/m³). Concentrations of PM_{2.5} at the 290 Broadway site (25 ± 22 ug/m³) were generally lower than those measured at Ground Zero through late October, 2001. Beginning in November, 2001, levels of PM_{2.5} decreased and were generally similar at the Ground Zero sites, but still somewhat higher than those measured at 290 Broadway. Dioxin and furan concentrations at a site located north of the WTC behaved similarly with elevated concentrations observed during October, 2001 that decreased and stabilized beginning in November, 2001. Analysis of the elemental composition of PM_{2.5} aerosols indicated elevated concentrations of crustal elements generally associated with building materials (e.g. Ca, S, Si, and K) suggesting that concrete and other building materials were pulverized. In addition, elevated concentrations of Pb were observed initially as were elements normally associated with iron and steel (e.g. Fe, Cr, Ni and Mn). Typically, PM_{2.5} levels at 290 Broadway were similar to upwind concentrations measured at Ground Zero indicating the regional background contribution to PM_{2.5}. However, when downwind of the plume, PM_{2.5} levels measured at 290 Broadway were considerably higher, a possible indication that the site was being impacted by the WTC plume. For example, the maximum integrated 24-hour PM_{2.5} concentrations were measured at Ground Zero (403 ug/m³) and 290 Broadway (100 ug/m³) during one such plume event. The event occurred in the early morning and was characterized by a peak in the 10-min. PM concentration of 1000 ug/m³ and a black carbon concentration of 180 ug/m³. This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D-00-206 to Mantech International. It has been subjected to Agency review and approved for publication.

Zartarian, V., Xue, J., and Ozkaynak, H. Quantifying aggregate chlorpyrifos exposure and dose to children using a physically-based two-stage Monte Carlo probabilistic model. Presented at: Society for Risk Analysis Conference, New Orleans, LA, December 8-11, 2002. 12/8/2002

Contact: Curtis M. Morris

Abstract:

Landis, M.S., Stevens, R.K., Prestbo, E., and Schaedlich, F.A. Standardized automated and manual methods to speciate mercury: field and laboratory studies. Presented at: 223rd American Chemical Society National Meeting, Orlando, FL, April 7-11, 2002. 4/7/2002

Contact: Matthew S. Landis

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

Landis, M.S., and Stevens, R.K. Preliminary results from the US EPA mercury speciation network and aircraft measurement campaigns. Presented at: 223rd American Chemical Society National Meeting, Orlando, FL, April 7-11, 2002.

4/7/2002

Contact: Matthew S. Landis

Abstract: Since EPA measured high concentrations of reactive gaseous mercury (RGM) in emissions from municipal and hospital waste incinerators in 1995, we have been working to elucidate the role of RGM on atmospheric mercury deposition. EPA has recently established automated speciated mercury monitoring sites in Coral Springs, Florida; Cheeka Peak, Washington; Barrow, Alaska; and Mauna Loa, Hawaii. In addition, EPA has conducted over thirty mercury research aircraft sorties off Florida's Atlantic coast and in Barrow, Alaska. At each site or study, specific sets of measurements will contribute to our overall understanding of the mechanisms of transformation of Hg⁰ to RGM and to particulate phase mercury. We will present data from all our studies and discuss the results in terms of homogenous and heterogeneous atmospheric oxidation mechanisms, long-range transport, source receptor relationships and long-term global baseline measurements and modeling. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to peer review and approved for publication.

BOOK CHAPTER

Lindstrom, A.B., and Pleil, J.D. "Volatile organic compounds as exposure biomarkers." In: Disease Markers in Exhaled Breath, First Edition N. Marczin & M.H. Yacoub (Ed.), Amsterdam, The Netherlands: IOS Press.

9/25/2002

Contact: Andrew B. Lindstrom

Abstract: Alveolar breath sampling and analysis can be extremely useful in exposure assessment studies involving volatile organic compounds (VOCs). Over recent years scientists from the US Environmental Protection Agency's National Exposure Research Laboratory have developed and refined an alveolar breath collection and analysis technique called the Single Breath Canister (SBC) method which has been applied in a wide range of investigations. This review covers the development of this breath collection technique in the laboratory and the application of this methodology in a range of field studies. Together these studies show how exhaled breath analysis can be used to clearly demonstrate recent exposures to VOCs, to determine compound-specific uptake and elimination kinetics, and to assess the relative importance of various exposure routes (i.e., dermal, ingestion, inhalation) in multipathway scenarios. Specific investigations covered in this overview include: an assessment of exposures related to the residential use of contaminated groundwater; exposures to gasoline and fuel additives at self-service gas stations; swimmers' exposures to trihalomethanes; and occupational exposures to jet fuel vapors. This work has been funded wholly by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication.

Knaak, J.B., Dary, C.C., Patterson, G.T., and Blancato, J.N. "Worker hazard posed by reentry into pesticide-treated foliage: reassessment of reentry levels/intervals using foliar residue transfer - percutaneous absorption PBPK/PD models, with emphasis on isofenphos and parathion." In: Human and Ecological Risk Assessment: Theory and Practice, Chapter 13 New York, NY: John Wiley & Sons, Inc. 2002, 673-731.

5/1/2002

Contact: Curtis C. Dary

Abstract:

Jan 1, 2002 - Dec 31, 2002

Presented Published

JOURNAL

Zidek, J., Sun, L., Le, N.D., and Ozkaynak, H. Contending with space-time interaction in the spatial prediction of pollution: Vancouver's hourly ambient PM 10 field. *Environmetrics* 13 (5-6):595-613 (2002).

9/30/2002

Contact: Haluk A. Ozkaynak

Abstract: In this article we describe an approach for predicting average hourly concentrations of ambient PM10 in Vancouver. We know our solution also applies to hourly ozone fields and believe it may be quite generally applicable. We use a hierarchical Bayesian approach. At the primary level we model the logarithmic field as a trend model plus a Gaussian stochastic residual. That trend model depends on hourly meteorological predictors and is common to all sites. The stochastic component consists of a 24 hour vector response that we model as a multivariate AR(3) temporal process with common spatial parameters. Removing the trend and AR structure leaves "whitened" time series of vector series. With this approach (as opposed to using 24 separate univariate time series models), little loss of spatial correlation in these residuals compared with that in just the detrended residuals (prior to removing the AR component). Moreover, our multivariate approach enables predictions for any given hour to "borrow strength" through its correlation with adjoining hours. On this basis we develop a spatial predictive distribution for these residuals at unmonitored sites. By transforming the predicted residuals back to original data scales we can impute Vancouver's hourly PM10 field.

The U.S. Environmental Protection Agency through its Office of Research and Development partially funded the research described here under a Cooperative Agreement #CR825267-01 to Harvard University School of Public Health. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

Kleindienst, T.E., Corse, E.W., Li, W., McIver, C.D., Conner, T.S., Edney, E.O., Driscoll, D.J., Speer, R.E., Weathers, W.S., and Tejada, S.B. Secondary organic aerosol formation from the irradiation of simulated automobile exhaust. *Journal of the Air & Waste Management Association* 52 (3):259-272 (2002). EPA/600/J-02/126.

3/1/2002

Contact: Edward O. Edney

Abstract: A laboratory study was conducted to evaluate the potential for secondary organic aerosol formation from emissions from automotive exhaust. The goal was to determine to what extent photochemical oxidation products of these hydrocarbons contribute to secondary organic aerosol (SOA) and how well their formation is described by recently developed models for SOA formation. The quality of the surrogate was tested by comparing its reactivity with that from irradiations of authentic automobile exhaust. Experiments for secondary particle formation using the surrogate were conducted in a fixed volume reactor operated in a dynamic mode. The mass concentration of the aerosol was determined from measurements of organic carbon collected on quartz filters which was corrected for the presence of hydrogen, nitrogen, and oxygen atoms in the organic species. A functional group analysis of the aerosol made by FTIR indicated that carbonyl groups dominated the aerosol with relatively little aliphatic or aromatic C-H functionality. This result is consistent with the presence of polycarbonyl compounds measured in the aerosol. The hygroscopic potential of the aerosol was determined with the use of a liquid water content analyzer and the analysis indicated that the aerosol uptake of water was minor at relative humidities below 70%. The yield for the formation of secondary organic aerosol yield was found to be 1.8% when measured for an aerosol mass of 7.38 $\mu\text{g m}^{-3}$. These results were compared to an aerosol model developed by Odum and co-workers and suggested that 75-85% of the fine particulate matter was due to reaction products of aromatic precursors. Organic analysis of the collected aerosol from this complex system indicates that the identified oxidation products were identical to those found in the toluene oxidation system. The U. S. Environmental Protection Agency through its Office of Research and Development funded and collaborated in the research described here under Contract 68-D5-0049 to Man Tech Environmental Technology, Inc. It has been subject to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

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Presented Published

Tulve, N.S., Suggs, J.C., McCurdy, T.R., Cohen-Hubal, E.A., and Moya, J. Frequency of mouthing behavior in young children. *Journal of Exposure Analysis and Environmental Epidemiology* 12:259-264 (2002). EPA/600/J-02/392.

7/9/2002

Contact: Thomas R. Mccurdy

Abstract: Young children may be more likely than adults to be exposed to pesticides following a residential application as a result of hand- and object-to-mouth contacts in contaminated areas. However, relatively few studies have specifically evaluated mouthing behavior in children less than 5 years of age. Previously unpublished data collected by the Fred Hutchinson Cancer Research Center (FHCRC) were analyzed to assess the mouthing behavior of 72 children (37 male/35 female). Total mouthing behavior data included the daily frequency of both mouth and tongue contacts with hands, other body parts, surfaces, natural objects, and toys. Eating events were excluded. Children ranged in age from 11 to 60 months. Observations for more than one day were available for 78% of the children. The total data set was disaggregated by gender into 5 age groups (10-20, 20-30, 30-40, 40-50, 50-60 months). Statistical analyses of the data were then undertaken to determine if significant differences existed among the age/gender subgroups in the sample. A mixed effects linear model was used to test the associations between age, gender, and mouthing frequencies. Subjects were treated as random and independent, and intra-subject variability was accounted for with an autocorrelation function. Results indicated that there was no association between mouthing frequency and gender. However, a clear relationship was observed between mouthing frequency and age. Using a tree analysis, two distinct groups could be identified: children <24 and children >24 months of age. Children <24 months exhibited the highest frequency of mouthing behavior with 81+7 events/hr (mean+std err) (n=28 subj, 69 obs). Children >24 months exhibited the lowest frequency of mouthing behavior with 42+4 events/hr (n=44 subj, 117 obs). These results suggest that children are less likely to place objects into their mouths as they age. These changes in mouthing behavior as a child ages should be accounted for when assessing aggregate exposure to pesticides in the residential environment. This work has been funded wholly by the United States Environmental Protection Agency under EPA Cooperative Agreement CR 816334-01 to the Fred Hutchinson Cancer Research Center. It has been subjected to Agency review and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Baldauf, R.W., Wiener, R.W., and Heist, D.K. Methodology for siting ambient air monitors at the neighborhood scale. *Journal of the Air & Waste Management Association* 52 (0):11433-1442 (2002).

12/1/2002

Contact: Russell W. Wiener

Abstract: In siting a monitor to measure compliance with U.S. National Ambient Air Quality Standards for particulate matter (PM), there is a need to characterize variations in PM concentration within a neighborhood-scale region in order to achieve monitor siting objectives. We provide here a simple methodology for the selection of a neighborhood-scale site for meeting either of the two objectives identified for PM monitoring. This methodology is based on analyzing middle-scale (from 100 to 500 m) data from within the area of interest. The required data can be obtained from widely available dispersion models and emissions databases. The performance of the siting methodology was evaluated in a neighborhood-scale field study conducted in Hudson County, NJ, to characterize the area's inhalable particulate (PM10) concentrations. Air monitors were located within a 2- by 2-km area in the vicinity of the Lincoln Tunnel entrance in Hudson County. Results indicate the siting methodology performed well, providing a positive relationship between the predicted concentration rank at each site and the actual rank experienced during the field study. Also discussed are factors that adversely affected the predictive capabilities of the model. The U.S. Environmental Protection Agency through its Office of Research and Development funded and collaborated in the research described here under cooperative agreement CR-815152-02 with the University of North Carolina at Chapel Hill and under contract 68-D-00-206 to ManTech Environmental Technology, Inc. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Cardello, N., Volckens, J., Tolocka, M.P., Wiener, R.W., and Buckley, T.J. Technical Note: Performance of a personal electrostatic precipitator particle sampler. *Aerosol Science and Technology* 36 (2):162-165 (2002). EPA/600/J-02/362.

2/1/2002

Contact: Russell W. Wiener

Abstract: Filter-based methods used to measure aerosols with semi-volatile constituents are subject to biases from adsorption and volatilization that may occur during sampling (McDow et al., 1990; Turpin et al., 1994; Volckens et al., 1999; Tolocka et al. 2001). The development and evaluation of suitable methods for quantitative measurement of semi-volatile organic aerosols is of public health significance because this class of chemicals can include polycyclic aromatic hydrocarbons, pesticides, and many other known toxins (Harkov, 1986; Finlayson-Pitts and Pitts, 1999). Furthermore, the need exists for personal exposure measurements, since micro-environmental or outdoor surrogates have been shown to have limited utility (Wallace, 1996; Rodes et al. 1991). Previous laboratory and field studies have demonstrated that electrostatic precipitation may be an effective means for sampling such aerosols (Leith, et al., 1996; Volckens et al. 1999, 2000). However, samples of semi-volatile aerosols collected by electrostatic precipitators (ESPs) are susceptible to reactions and degradation due to ozone generated by the corona (Kaupp and Umlauf, 1992). Although the effect of electrode polarity, humidity, temperature, and geometry on ozone generation in corona discharges has been investigated for air cleaning devices (White, 1963; Castle, 1964; Viner et al. 1993; Abdel-Salam et al. 1997; Boelter et al. 1997) and xerographic photocopiers and printers (Nashimoto, 1998), such data are currently unavailable to assess the performance of this new air sampling device. Recently, electrode type has been identified a major factor affecting ozone generation in electrostatic instruments (Nashimoto, 1983; Boelter et al., 1997). This paper builds on prior studies of electrostatic devices by evaluating and optimizing the effect of design properties on the ozone generation and collection efficiency of a unique personal ESP particle sampler. The overall objective of this research is to develop an improved method for sampling aerosols with semi-volatile constituents. This article has been subjected to Agency review and approved for publication.

Eisner, A.D., and Wiener, R.W. Discussion and evaluation of the volatility test for equivalency of other methods to the federal reference method for fine particulate matter. *Aerosol Science and Technology* 36 (4):433-440 (2002). EPA/600/J-02/355.

4/1/2002

Contact: Russell W. Wiener

Abstract: In July 1997, EPA promulgated a new National Ambient Air Quality Standard (NAAQS) for fine particulate matter (PM_{2.5}). This new standard was based on collection of an integrated mass sample on a filter. Field studies have demonstrated that the collection of semivolatile compounds leads to artifacts and imprecision among methods. In view of such sampling artifacts, a test requirement was promulgated in Title 40, Part 53, Subpart F, Section 53.66 of the Code of Federal Regulations (40CFR53.66) to aid in the determination of methodological equivalency. In this paper, this requirement is critically reviewed and tested in terms of its feasibility and precision. The results show that the test is capable of demonstrating acceptable precision for FRM-type samplers and repeatable differences in performance among different methods. In order to maintain high precision within the entire test procedure, the loading time should be extended to 2 h for flow rates of 16.7 lpm and proportionately longer for lower flow rates. The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described here under Contract 68-D5-0049 to ManTech Environmental Technology, Inc. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

McClenny, W.A., Williams, E.J., Cohen, R.C., and Stutz, J. Preparing to measure the effects of the NOx SIP call - methods for ambient air monitoring of NO, NO₂, NOy and individual NO_z species. Journal of the Air & Waste Management Association 52 (5):542-562 (2002). EPA/600/J-02/354.

5/1/2002

Contact: William A. McClenny

Abstract: The capping of stationary source emissions of NO_x in 22 states and the District of Columbia is federally mandated by the NO_x SIP Call legislation with the intended purpose of reducing downwind ozone concentrations. Monitors for NO, NO₂, and the reactive oxides of nitrogen into which these two compounds are converted will record data to evaluate air quality model (AQM) predictions. Guidelines for testing of these models indicate the need for semi-continuous measurements as close to real time as possible but no less frequently than once per hour. The measurement uncertainty required for AQM testing must be less than ?20% (?10% for NO₂) at mixing ratios of 1- ppbv and higher for NO, individual NO_z component compounds, and NOy. This article is a review and discussion of different monitoring methods, some currently used in research and others used for routine monitoring. The performance of these methods is compared to the monitoring guidelines. Recommendations for advancing speciated and total NOy monitoring technology and a listing of demonstrated monitoring approaches are also presented. The U.S. Environmental Protection Agency through its Office of Research and Development collaborated in the preparation of this manuscript. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

Nishioka, M.G., Lewis, R.G., Brinkman, M.C., and Burkholder, H.M. Foot transfer of lawn applied pesticides from turf to carpet: comparison of semivolatile chlorpyrifos with nonvolatile chlorothalonil. Bulletin of Environmental Contamination and Toxicology 68 (1):64-71 (2002). EPA/600/J-02/068.

1/15/2002

Contact: Robert G. Lewis

Abstract: Residues of pesticides are found on lawns after direct applications or as a result of drift from applications to ornamentals, gardens, or perimeters of buildings. These residues dissipate by volatilization, transport to soil by rainfall or watering, photochemical and microbial degradation, and other mechanisms. The lifetimes of pesticide residues on turf are generally short relative to those on indoor surfaces. Many of the pesticides identified in house dust and indoor air obviously have outdoor sources. The presence in house dust of pesticides that are typically used on the lawn or garden, suggest track-in of turf and soil residues. The study described here was conducted to examine the temporal behavior of dislodgeable turf residues of two pesticides that have been commonly used on lawns and estimate the extent to which they may be tracked into a home by normal walking and entry into the home. This study was carried out to compare dislodgeable turf residue levels and track-in rates for differing pesticides, application methods, and application rates. The applicability of this test design, and comparison of chemical factors such as volatility and water solubility to significantly different pesticides were evaluated here with the insecticide chlorpyrifos in both emulsifiable concentrate (EC) spray and granular applications and the fungicide chlorothalonil in an EC formulation. The U.S. Environmental Protection Agency through its Office of Research and Development funded the research described here under Contract No. 68-DO-0007 to Battelle. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial product does not constitute endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Liu, S., and Pleil, J.D. Human blood and environmental media screening method for pesticides and polychlorinated biphenyl compounds using liquid extraction and gas chromatography-mass spectrometry analysis. *Journal of Chromatography: B Biomedical Sciences and Applications* 769 (1):155-167 (2002). EPA/600/J-02/356.

3/15/2002

Contact: Joachim D. Pleil

Abstract: Screening assessment methods have been developed for semi- and non-volatile persistent organic pollutants (POPs) for human blood and solid environmental media. The specific methodology is developed for measuring the presence of "native" compounds, specifically, a variety of organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), and for polychlorinated biphenyls (PCBs). The method is demonstrated on anonymous Red Cross blood samples as well as two potential environmental sources, tracked in soil and dog hair. This work is based on previously developed methods for semi-volatile hydrocarbon exposure from fuels usage and similarly employs liquid solvent extraction, evaporative volume reduction, and subsequent specialized gas chromatography - mass spectrometry analysis (GC-MS). Standard curves, estimates of recovery efficiency, and specific GC-MS SIM quantization methods were developed for common pesticides including diazinon, aldrin, chlorpyrifos, malathion, dieldrin, DDT, permethrin, cyhalothrin, and cypermethrin, and for seven selected PCBs. Trace levels of certain PCBs and pesticides such as permethrin, dieldrin, malathion, lindane, diazinon, and chlorpyrifos were tentatively identified in anonymous blood samples as well as in two potential environmental sources, tracked in soil and dog hair. The method provides a simple screening procedure for various media and a variety of common organic pollutants without extensive sample preparation. It is meant to complement and augment data from more specific or complex methodology, to provide initial broad spectrum guidance for designing targeted experiments, and to provide confirmatory evidence for the usual metabolic biomarker measurements made to assess human exposure. This work was funded by the National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, through Contract 68-D5-0049 with ManTech Environmental Technology, Inc. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Lindstrom, A.B., and Pleil, J.D. A review of the US EPA's single breath canister (SBC) method for exhaled volatile organic biomarkers. *Biomarkers* 7 (3):189-208 (2002). EPA/600/J-02/428.

5/1/2002

Contact: Andrew B. Lindstrom

Abstract: Exhaled alveolar breath can provide a great deal of information about an individual's health and previous exposure to potentially harmful xenobiotic materials. Because breath can be obtained noninvasively and its constituents directly reflect concentrations in the blood, its use has wide potential application in the field of biomarker research. This paper reviews the utility and application of the single breath canister (SBC) method of alveolar breath collection and analysis first developed by the US Environmental Protection Agency (USEPA) in the 1990s. This review covers the development of the SBC technique in the laboratory and its application in a range of field studies. Together these studies specifically show how the SBC method (and exhaled breath analysis in general) can be used to clearly demonstrate recent exposures to volatile organic compounds (VOCs), to link particular activities to specific exposures, to determine compound-specific uptake and elimination kinetics, and to assess the relative importance of various routes of exposure (i.e. dermal, ingestion, inhalation) in multipathway scenarios. Specific investigations covered in this overview include an assessment of exposures related to the residential use of contaminated groundwater, exposures to gasoline and fuel additives at self-service gas stations, swimmers' exposures to trihalomethanes, and occupational exposures to jet fuel. The US Environmental Protection Agency through its Office of Research and Development wholly funded and managed the research described here. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Eisner, A.D., Heist, D.K., Drake, Z.E., Mitchell, W.J., and Wiener, R.W. On the impact of the human (child) microclimate on passive aerosol monitor performance. *Aerosol Science and Technology* 36 (7):803-813 (2002). EPA/600/J-02/361.

7/1/2002

Contact: Curtis M. Morris

Abstract: Research into the wind microclimate and its effect on the accuracy and effectiveness of passive aerosol monitors is expanding as the importance of personal monitoring versus regional monitoring increases. The important phenomena for investigation include thermal and dynamic effects of the human body, contaminant dispersion around a human body and within a building complex, and the wind environment within a building (indoor/outdoor) complex. This paper demonstrates that the microclimate around the human body plays a critical role in contaminant transport near the body and thus can affect particle concentration measurements by personal samplers. The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described here under Contract 68-D-00-206 to ManTech Environmental Technology, Inc. It has not been subjected to Agency review and therefore does not necessarily reflect the views of the Agency, and no official endorsement should be inferred.

Gordon, S.M., Wallace, L.A., Brinkman, M.C., Callahan, P.J., and Kenny, D.V. Volatile organic compounds as breath biomarkers for active and passive smoking. *Environmental Health Perspectives* 110 (7):689-698 (2002). EPA/600/J-02/357.

7/1/2002

Contact: Lance A. Wallace

Abstract: Real-time breath measurement technology was used to investigate the suitability of some volatile organic compounds (VOCs) to serve as breath biomarkers for active and passive smoking and to measure actual exposures and resulting breath concentrations for persons exposed to tobacco smoke. Experiments were conducted with five smoker/non-smoker pairs. The target VOCs included benzene, 1,3-butadiene, and the cigarette smoke biomarker 2,5-dimethylfuran. The approach adopted was to have pairs of volunteers in a small, unventilated room, one smoker and one non-smoker, and to have the smoker smoke three cigarettes in fairly quick succession. After each puff, the smoker exhaled into the room air to clear his/her lungs of smoke, and subsequent exhalations were measured using the continuous real-time breath analyzer until the occurrence of the next puff. A series of sawtooth curves resulted, representing the sharp increase and subsequent decrease of the target chemicals in the smoker's blood. After the final puff from each of the first three cigarettes, the longer-term decay of the compounds in the smoker's breath was monitored. The smoker then smoked a fourth and final cigarette, but this time the non-smoker's breath was monitored for the same chemicals. The uptake of the chemicals due to the cigarette smoke in the room was determined for the non-smoker. This study includes what are believed to be the first measurements of 1,3-butadiene in smoker's and non-smoker's breath. The 1,3-butadiene and 2,5-dimethylfuran peak levels in the smokers' breath were similar (360 and 376 mg/m³, respectively) while the average benzene peak level was 522 mg/m³. The real-time breath analyzer also showed the presence of the chemicals after exposure in the breath of the non-smokers, but at greatly reduced levels. Single breath samples collected and analyzed independently, using evacuated canisters and gas chromatography/mass spectrometry, confirmed the presence of the target compounds in the post-exposure breath of the non-smokers, but indicated that there was some contamination of the breath analyzer measurements. This was likely due to desorption of organics from condensed ?tar? in the analyzer tubing and on the quartz fiber filter used to remove particles. The decay data from the smokers were used to estimate residence times for the target chemicals. A two-compartment exponential model generally gave a better fit to the experimental decay data from the smokers than a single-compartment model. Residence times for benzene, 1,3-butadiene, and 2,5-dimethylfuran ranged from 0.5 (1,3-butadiene) to 0.9 min (benzene) for t₁ and were essentially constant (14 min) for t₂. These findings will be useful in models of environmental tobacco smoke exposure and risk. The research described in this paper has been funded wholly or in part by the United States Environmental Protection Agency under Contract 68-D4-0023 to Battelle Memorial Institute. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Presented Published

Howard-Reed, C., Wallace, L.A., and Ott, W.R. The effect of opening windows on air change rates in two homes. *Journal of the Air & Waste Management Association* (2001).

2/1/2002

Contact: Lance A. Wallace

Abstract: Over 300 air change rate experiments were completed in two occupied residences: a two-story detached house in Redwood City, CA and a three-story townhouse in Reston, VA. A continuous monitor was used to measure the decay of sulfur hexafluoride tracer gas over periods of 1 to 18 hours. Each experiment included a measurement of the air change rate first with all exterior doors and windows closed (State 0), then with the single change from State 0 conditions of opening one or more windows. The overall average State 0 air change rate was 0.37 air changes per hour (h^{-1}) ($\text{SD} = 0.10 \text{ h}^{-1}$; $n = 112$) for the California house and 0.41 h^{-1} ($\text{SD} = 0.19 \text{ h}^{-1}$; $n = 203$) for the Virginia house. Indoor-outdoor temperature differences appeared to be responsible for the variation at the Virginia house of 0.15 h^{-1} to 0.85 h^{-1} when windows were closed. Opening a single window increased the State 0 air change rate by an amount roughly proportional to the width of the opening, reaching increments as high as 0.80 h^{-1} in the California house and 1.3 h^{-1} in the Virginia house. Multiple window openings increased the air change rate by amounts ranging from 0.10 h^{-1} to 2.8 h^{-1} in the California house and from 0.49 h^{-1} to 1.7 h^{-1} in the Virginia house. Compared to temperature differences and wind effects, opening windows produced the greatest increase in the air change rates measured in both homes. Results of this study indicate the importance of occupant window opening behavior on a home's air change rate and the consequent need to incorporate this factor when estimating human exposure to indoor air pollutants. The EPA, through its Office of Research and Development, funded and managed part of the research described herein. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

LaRosa, L., Buckley, T.J., and Wallace, L.A. Real-time indoor and outdoor measurements of black carbon in an occupied house: an examination of sources. *Journal of the Air & Waste Management Association* 52:41-49 (2002). EPA/600/J-02/493.

1/1/2002

Contact: Lance A. Wallace

Abstract: Black carbon (BC) was measured every five minutes for two years (May, 1998 to May 2000) inside and immediately outside a northern Virginia house (suburban Washington, DC) occupied by two nonsmokers. Two Aethalometers TM, which measure BC by optical transmission through a quartz fiber tape, were employed indoors and outdoors. Meteorological parameters were obtained on an hourly basis from the nearby Dulles airport. Indoor activities were recorded to identify indoor sources such as combustion activities, which occurred 9% of the time during the first year and 4% of the time during the second year. At times without indoor sources, indoor/outdoor BC ratios averaged 0.52 in the first year and 0.35 in the second year. The main outdoor source of BC was the general regional background, contributing 83-84% of the total during each of the two years. Morning rush-hour traffic contributed 8-9% of the total. An evening peak in the fall and winter, thought to include contributions from woodburning, was responsible for about 8% of the annual average BC concentration. The main indoor sources of BC were cooking and candle burning, contributing 16% and 31% of the annual average indoor concentrations in the two years. Relative humidity (RH) affected the outdoor Aethalometer TM in both years. An artifact associated with the tape advance was noted for the Aethalometer TM, but a correction factor was developed that reduced the associated error by a factor of 2. This research was partially funded by the Environmental Protection Agency. This paper has been reviewed and approved for publication. However, the paper does not necessarily reflect the policy of the EPA. Use of brand names does not imply endorsement.

Blair, A., Tarone, R., Sandler, D., Lynch, C., Rowland, A.S., Wintersteen, W., Steen, W.C., Samanic, C., Dosemeci, M., and Alavanja, M. Reliability of reporting on lifestyle and agricultural factors by a sample of participants in the agricultural health study from Iowa: +. *Epidemiology* 13 (1):94-99 (2002). EPA/600/J-02/494.

1/1/2002

Contact: Kent W. Thomas

Abstract: Repeat interviews from 4,088 Iowa pesticide applicators participating in the Agricultural Health Study provided the opportunity to evaluate the reliability of self-reported information on pesticide use and various demographic and lifestyle factors. Self-completed questionnaires were administered one year apart when participants returned to county extension offices for pesticide certification or training. Percent agreement for ever/never use of specific pesticides and application practices was quite high, generally ranging from 70% to over 90%, and did not vary by age, educational level, or farm size. Agreement was lower (typically 50% to 60%) for duration, frequency, or decade of first use of specific pesticides. Level of agreement regarding pesticide use in this population is similar to that generally found for factors typically used in epidemiologic studies such as tobacco use and higher than typically reported for diet, physical activity, and medical conditions.

Jan 1, 2002 - Dec 31, 2002

Presented Published

Clayton, C.A., Pellizzari, E.D., and Quackenboss, J.J. National Human Exposure Assessment Survey (NHEXAS): analysis of exposure pathways and routes for arsenic and lead in EPA Region 5. *Journal of Exposure Analysis and Environmental Epidemiology* 12 (1):29-43 (2002). EPA/600/J-02/241.

1/1/2002

Contact: James J. Quackenboss

Abstract: The National Human Exposure Assessment Survey (NHEXAS) Phase I field study conducted in EPA Region 5 (Great Lakes Area) provides extensive exposure data on a representative sample of approximately 250 residents of the region. Associated environmental media and biomarker (blood, urine) concentration data were also obtained for the study participants to aid in understanding of the relationships of exposures to both contaminant pathways and doses. Besides fulfilling the primary NHEXAS objectives, the NHEXAS data provided an opportunity to explore secondary usages such as examining pathway to route of exposure relationships. A generic type of structural equation model was used to define the anticipated relationships among the various data types for both arsenic (As) and lead (Pb). Since, by design, only a few participants provided data for all sample types, implementing this model required that some media concentrations (outdoor air and soil) be imputed for subjects with missing information by using measurements collected in the same geographic area and time period. The model, and associated pairwise correlations, generally revealed significant but weak associations among the concentrations, exposures, and doses; the strongest associations occurred for the various air measurements (indoor versus outdoor and personal). The generally weak associations were thought to be partly due to the absence of complete coverage of non-residential environmental media and to non-synchronization of relevant measurement times and integration periods of collection across the various sample types. In general, relationships between the NHEXAS questionnaire data and the various concentration, exposure, and body-burden measures were also weak. The model results and the modeling exercise suggest several ways for optimizing the design of future exposure assessment studies that are aimed at supporting structural modeling activities.

Chough, S.H., Mulchandani, A., Mulchandani, P., Chen, W., Wang, J., and Rogers, K.R. Organophosphorus hydrolase-based amperometric sensor: modulation of sensitivity and substrate selectivity. *Electroanalysis* 14 (4):273-276 (2002). EPA/600/J-02/216.

3/11/2002

Contact: Kim R. Rogers

Abstract: The detection of organophosphate (OP) insecticides with nitrophenyl substituents is reported using an enzyme electrode composed of Organophosphorus Hydrolase (OPH) and albumin co-immobilized to a nylon net and attached to a carbon paste electrode. The mechanism for this biosensor involves catalysis of the OP followed by the electrochemical detection of the product, p-nitrophenol. The application of small amounts of mineral oil or silicon oil to the surface of the immobilized enzyme increased the stability and response signals of these sensors. In the case of silicon oil, the response for parathion was five times higher than without oil. In addition, the application of either mineral or silicon oil to the enzyme-coated membranes increased the relative selectivity of the sensor for parathion over paraoxon, most likely reflecting the partition of the substrates between the aqueous and oil phases. The enzyme activity was stabilized for more than two months by the application of either oil to the electrode surface. Compounds evaluated using this technique included parathion, EPN, fenitrothion, and paraoxon. The detection limits for parathion and paraoxon are 15 nM and 20 nM, respectively. These detection limits are substantially lower than those reported for optical assays (e.g., μ M range) and lower than those reported using several OPH electrodes (e.g., high nM range). Several characteristics that make this enzyme electrode attractive for further development as a potential field analytical method include; its simplicity and stability, as well as the relatively small amount of enzyme required (i.e., 3 International Units). The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), funded this research. It has been subject to the EPA's peer and administrative review and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA.

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Presented Published

Weetal, H.H., and Rogers, K.R. A simple assay for 2,4-dichlorophenoxyacetic acid using coated test-strips. Analytical Letters 35 (8):1341-1348 (2002). EPA/600/J-02/416.

8/5/2002

Contact: Kim R. Rogers

Abstract: Immunoassay test strips utilizing ascending chromatography has been devised for the detection of 2,4-dichlorophenoxyacetic acid (2,4-D). This test requires no instrumentation, inexpensive reagents and relies on the application of antibodies to 2,4-D adsorbed onto colloidal gold particles. The assay, although not completely optimized is capable of detecting 0.10ug/mL. The format for this assay involves addition of the unknown sample to a small test tube that contains 0.5 mL buffer and anti-2,4-D colloidal gold conjugate followed by addition of the test strip. For this assay, the anti-2,4-D gold conjugate co-migrates with the sample past pre-adsorbed bovine albumin labeled with 2,4-D (BSA-2,4-D). If 2,4-D is in the unknown sample at concentrations above the threshold value, then the colloidal gold-labeled anti-2,4-D antibody will not bind to the BSA-2,4-D adsorbed to the nitrocellulose strip but continue to migrate toward the top of the strip. To determine the presence of the analyte, the colloidal gold labeled antibody that binds to the BSA-2,4-D zone (as determined by a visible purpose band) is compared to positive (containing concentrations of 2,4-D above 0.02 ug/ml) and negative controls (containing no analyte). The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), has funded and performed the research described. This manuscript has been subjected to the EPA's peer and administrative review and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation by the US EPA.

Lioy, P.J., Weisel, C.P., Millette, J.R., Eisenreich, S., Vallero, D.A., Offenberg, J., Buckley, B., Turpin, B., Zhong, M., Cohen, M.D., Prophete, C., Yang, I., Stiles, R., Chee, G., Johnson, W., Alimokhtari, S., Weschler, C., and Chen, L.C. Characterization of the dust/smoke aerosol that settled east of the World Trade Center (WTC) in Lower Manhattan after the collapse of the WTC 11 September 2001. Environmental Health Perspectives 110 (7):703-712 (2002). EPA/600/J-02/420.

7/1/2002

Contact: Roy B. Zweidinger

Abstract: The explosion and collapse of the World Trade Center (WTC) was a catastrophic event that produced an aerosol plume impacting many workers, residents, and commuters during the first few days after 11 September 2001. Three bulk samples of the total settled dust and smoke were collected at weather-protected locations east of the WTC on 16 and 17 September 2001; these samples are representative of the generated material that settled immediately after the explosion and fire and the concurrent collapse of the two structures. We analyzed each sample, not differentiated by particle size, for inorganic and organic composition. In the inorganic analyses, we identified metals, radionuclides, ionic species, asbestos, and inorganic species. In the organic analyses, we identified polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls, polychlorinated dibenzodioxins, polychlorinated dibenzofurans, pesticides, phthalate esters, brominated diphenyl ethers, and other hydrocarbons. Each sample had a basic pH. Asbestos levels ranged from 0.8% to 3.0% of the mass, the PAHs were > 0.1% of the mass, and lead ranged from 101 to 625 ug/g. The content and distribution of material was indicative of a complex mixture of building debris and combustion products in the resulting plume. These three samples were composed primarily of construction materials, soot, paint (leaded and unleaded), and glass fibers (mineral wool and fiberglass). Levels of hydrocarbons indicated unburned or partially burned jet fuel, plastic, cellulose, and other materials that were ignited by the fire. In morphologic analyses we found that a majority of the mass was fibrous and composed of many types of fibers (e.g., mineral wool, fiberglass, asbestos, wood, paper, and cotton). The particles were separated into size classifications by gravimetric and aerodynamic methods. Material < 2.5 um in aerodynamic diameter was 0.88-1.98% of the total mass. The largest mass concentrations were > 53 um in diameter. The results obtained from these samples can be used to understand the contact and types of exposures to this unprecedented complex mixture experienced by the surviving residents, commuters, and rescue workers directly affected by the plume from 11 to 12 September and the evaluations of any acute or long-term health effects from resuspendable dust and smoke to the residents, commuters, and local workers, as well as from the materials released after 11 September until the fires were extinguished. Further, these results support the need to have the interior of residences, buildings, and their respective HVAC systems professionally cleaned to reduce long-term residential risks before rehabilitation. This work was funded in part by supplemental funds from the National Institute of Environmental Health Sciences (NIEHS) to the NIEHS Centers at EOHSI (ES05022-12) and the NYU Institute of Medicine (ES00260). NYU is also funded in part by a U.S. Environmental Protection Agency (EPA) PM Center Grant (R827351). P.J. Lioy was also supported in part by a U.S. EPA University Partnership (CR827033). This work has been subjected to agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendations for use.

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Presented Published

Mukerjee, S. Communication strategy of transboundary air pollution findings in a U.S.-Mexico Border XXI program project. Environmental Management (New York, NY: Springer-Verlag, Inc.) 29 (1):34-56 (2002). EPA/600/J-02/065.

1/2/2002

Contact: Shaibal Mukerjee

Abstract: From 1996 to 1997, the U.S. Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC) conducted an air quality study known as the Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP). The study was a U.S.-Mexico Border XXI Program project and was developed in response to local community requests on a need for more air quality measurements and concerns about the health impact of local air pollutants; this included concerns about emissions from border-dependent industries in Mexico, known as maquiladoras. The TAPP was a follow-on study to environmental monitoring done by EPA in this area in 1993 and incorporated scientific and community participation in development, review of results, and public presentation of findings. In spite of this, critical remarks were leveled by community activists against the study's preliminary "good news" findings regarding local air quality and the influence of transboundary air pollution. To resolve these criticisms and to refine the findings to address these concerns, analyses included comparisons of daily and near real time measurements to TNRCC Effects Screening Levels and data from other studies along with wind sector analyses. Reassessment of the data suggested that although regional source emissions occurred and outliers of elevated pollutant levels were found, movement of air pollution across the border did not appear to cause noticeable deterioration of air quality. In spite of limitations stated to the community, the TAPP was presented as establishing a benchmark to assess current and future transboundary air quality in the Valley. The study has application in Border XXI Program or other air quality studies where transboundary transport is a concern since it involved inter-agency coordination, public involvement, and communication of scientifically-sound results for local environmental protection efforts. The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under Contract No. 68-D5-0049 to ManTech Environmental, Inc. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Vette, A.F., Landis, M.S., and Keeler, G.J. Deposition and emission of gaseous mercury to and from Lake Michigan during the Lake Michigan mass balance study (July, 1994 - October, 1995). Environmental Science & Technology 36 (21):4525-4532 (2002). EPA/600/J-02/417.

7/30/2002

Contact: Matthew S. Landis

Abstract: This paper presents measurements of dissolved gaseous mercury (DGM) concentrations in Lake Michigan and the application of a mechanistic approach to estimate deposition and emission fluxes of gaseous mercury (Hg^{2+} and Hg^0) to and from Lake Michigan. Measurements of DGM concentrations made during May and July, 1994 and January, 1995 indicate that Lake Michigan was supersaturated with DGM suggesting that transfer of Hg^0 occurs from the water to the atmosphere. Over-water concentrations of gaseous Hg^{2+} were estimated from total gaseous Hg (TGM) concentrations measured at five sites in the basin and used to model dry deposition fluxes of Hg^{2+} . The modeling approach combines estimates of dry deposited Hg^{2+} with known photochemical and biotic reduction rates to form Hg^0 , which is available for re-emission. The model accounts for temporal and spatial variations in the deposition velocity of gaseous Hg^{2+} and the transfer velocity of Hg^0 using high temporal and spatial resolution meteorological data. The modeled DGM concentrations agree well with the observed DGM concentrations in Lake Michigan. The modeled dry deposition fluxes of Hg^{2+} (286-797 kg yr⁻¹) are very similar to the emission fluxes of Hg^0 (320-959 kg yr⁻¹), depending on the gaseous Hg^{2+} concentration used in the model. The U.S. Environmental Protection Agency through its Office of Research and Development funded the research described here under cooperative agreement # CR820909-01 and its Great Lakes National Programs Office under grant # GL995569-01 to the University of Michigan Air Quality Laboratory. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

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Presented Published

Lindberg, S.E., Brooks, S., Lin, C.J., Scott, K.J., Landis, M.S., Stevens, R.K., Goodsite, M., and Richter, A. Dynamic oxidation of gaseous mercury in the arctic troposphere at polar sunrise. Environmental Science & Technology 36 (6):1245-1256 (2002). EPA/600/J-02/318.

2/13/2002

Contact: Matthew S. Landis

Abstract: Gaseous elemental mercury (Hg₀) is a globally distributed air toxin with a long atmospheric residence time. Any process that reduces its atmospheric lifetime increases its potential accumulation in the biosphere. Our data from Barrow, AK, at 71°N show that rapid, photochemically driven oxidation of boundary-layer Hg₀ after polar sunrise, probably by reactive halogens, creates a rapidly depositing species of oxidized gaseous mercury in the remote Arctic troposphere at concentrations in excess of 900 pg m⁻³. The mercury accumulates in the snowpack during polar spring at an accelerated rate in a form that is bioavailable to bacteria and is released with snowmelt during the summer emergence of the Arctic ecosystem. Evidence suggests that this is a recent phenomenon that may be occurring throughout the earth's polar regions.

Landis, M.S., Vette, A.F., and Keeler, G.J. Atmospheric mercury in the Lake Michigan basin: influence of the Chicago/Gary urban area. Environmental Science & Technology 36 (21):4508-4517 (2002). EPA/600/J-02/419.

7/30/2002

Contact: Matthew S. Landis

Abstract: The relative importance of the Chicago/Gary urban area was investigated to determine its impact on atmospheric mercury (Hg) concentrations and wet deposition in the Lake Michigan basin. Event wet-only precipitation, total particulate, and vapor phase samples were collected for Hg and trace element determinations from five sites around Lake Michigan from July 1994 through October 1995 as part of the Lake Michigan Mass Balance Study (LMMBS). In addition, intensive over-water measurements were conducted aboard the EPA research vessel Lake Guardian during the summer of 1994 and the winter of 1995 as part of the Atmospheric Exchange Over Lakes and Oceans Study. Atmospheric Hg concentrations were found to be significantly higher in the Chicago/Gary urban area than surrounding sites: Hg in precipitation was a factor of two and particulate Hg was a factor of six times higher. Over-water measurements found elevated Hg concentrations 19 km off shore of Chicago/Gary suggesting an enhanced near field atmospheric deposition to Lake Michigan. Meteorological transport analyses also determined that local sources in the Chicago/Gary urban area significantly impacted all of the LMMBS sites indicating a broad impact to the entire Lake Michigan basin. The U.S. Environmental Protection Agency through its Office of Research and Development (Cooperative Agreement CR820909-01) and its Great Lakes National Program Office (Grant GL995569-01) funded the research described here under to the University of Michigan Air Quality Laboratory (UMAQL). It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

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Presented Published

Klouda, G.A., Lewis, C.W., Stiles, D.C., Marolf, J.L., Ellenson, W.D., and Lonneman, W.A.
Biogenic contributions to atmospheric volatile organic compounds in Azusa CA. Journal of
Geophysical Research-Atmospheres 107 (D8):7-1-7-13 (2002). EPA/600/J-03/016.

4/27/2002

Contact: Charles W. Lewis

Abstract: An objective of the 1997 Southern California Ozone Study (SCOS97) was to provide an up-to-date assessment of the importance of biogenic emissions for tropospheric ozone production in the South Coast Air Basin. To this end ambient air samples were collected during September 1997 at the Azusa air monitoring station for subsequent measurement of their radiocarbon (^{14}C) content of the atmospheric non-methane volatile organic compound (VOC) fraction. The $^{14}\text{C}/^{12}\text{C}$ ratio is proportional to the fraction of a sample's carbon that is biogenic. The proportionality constant was determined from local samples of vegetation, gasoline and ambient CO_2 collected during the same period. The median fraction of biogenic VOC observed from 0600 h to 0900 h was 7 % ($n = 5$) with a range of -8 % to 24 %, from 1300 h to 1600 h it was 27 % ($n = 4$) with a range of 11 % to 39%, and from 1700 h to 2000 h it was 34 + or - 7 % for a single sample. Based on calculated 24-h back-trajectories, the dominant source region for the air masses associated with periods of high biogenic VOC levels was a sector extending from the north to the east. Over all time and space that the samples represent, the median fraction of biogenic VOC was 18 % ($n = 10$). Expressed as an atmospheric mixing ratio, the overall (median and 95 % confidence interval) biogenic VOC-carbon contribution was 80 + or - 50 nmol mol⁻¹ which may be representative of the natural VOC-carbon background for the Los Angeles air basin. This work was supported by the U.S. Environmental Protection Agency under Contract No. 68D50049, Interagency Agreement DW13937923-01-0, and by the National Institute of Standards and Technology. It has been subjected to Agency review and approved for publication. Certain commercial equipment, instruments, or materials are identified in this paper to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Landis, M.S., and Keeler, G.J. Atmospheric mercury deposition to Lake Michigan during the Lake Michigan mass balance study. Environmental Science & Technology 36 (21):4518-4524 (2002). EPA/600/J-02/418.

7/30/2002

Contact: Matthew S. Landis

Abstract: Wet and dry mercury (Hg) deposition were calculated to Lake Michigan using a hybrid receptor modeling framework. The model utilized mercury monitoring data collected during the Lake Michigan Mass Balance Study and the Atmospheric Exchange Over Lakes and Oceans Study together with high-resolution over-water meteorological data provided by the National Oceanic and Atmospheric Administration (July, 1994 - October, 1995). Atmospheric deposition was determined to be the primary pathway for mercury input to Lake Michigan, contributing approximately 84% of the estimated 1403 kg total annual input (atmospheric deposition + tributary input). Wet (10.6 ug m⁻²) and dry deposition (9.7 ug m⁻²) contributed almost equally to the annual atmospheric Hg deposition of 20.3 ug m⁻² (1173 kg). Reemission of dissolved gaseous Hg from the lake was also significant (7.8 ug m⁻²), reducing the net atmospheric deposition to 12.5 ug m⁻² (720 kg). A strong urban influence was observed in the over-water mercury deposition estimates in the southern portion of the lake. The Chicago/Gary urban area was estimated to contribute approximately 20% (127 kg) of the annual atmospheric mercury deposition to Lake Michigan. The magnitude of local anthropogenic mercury sources in the Chicago/Gary urban area suggests that emission reductions could significantly reduce atmospheric mercury deposition into Lake Michigan. The U.S. Environmental Protection Agency through its Great Lakes National Program Office (Grants GL985742-01-1 and GL 985430-01-2) funded the research described here under to the University of Michigan Air Quality Laboratory (UMAQL). It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

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Presented Published

SYMPOS/CONF

Fortmann, R.C., Sheldon, L.S., Cohen-Hubal, E.A., Morgan, M.K., Stout, II, D.M., Thomas, K.W., Tulve, N.S., and Whitaker, D.A. The EPA National Exposure Research Laboratory children's pesticide exposure measurement program. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/032 (NTIS PB2002-106286).

6/30/2002

Contact: Roy C. Fortmann

Abstract: The U.S. Environmental Protection Agency (EPA) National Exposure Research Laboratory (NERL) is performing research in support of the Food Quality Protection Act (FQPA) of 1996. This act requires that pesticide exposure assessments to be conducted for all potential sources, routes and pathways, not just dietary intake. The goal of the NERL program is to develop and evaluate protocols and methods for assessing children's aggregate and cumulative exposures to pesticides, and to collect data required to reduce the reliance on default assumptions in development of quantitative exposure assessments. This paper provides an overview of the framework and approach for the research program and descriptions of studies being performed to fill data gaps in the following areas: Spatial and temporal distribution of pesticide residues indoors, Pesticide use patterns indoors, Dermal exposure, Indirect ingestion exposure, Microenvironments and macroactivity patterns of children, and Children's exposure measurements protocols and methods.

This paper has been reviewed in accordance with the United States Environmental Protection Agency's peer and administrative review policies and approved for presentation and publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Stout, II, D.M., and Mason, M.A. The distribution of chlorpyrifos following a crack and crevice type application in the U.S. EPA indoor air quality test house. Presented at: 9th International Conference on Indoor Air Quality and Climate, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/059 (NTIS PB2002-106742).

6/30/2002

Contact: Daniel M. Stout

Abstract: Pesticides found in homes may result from indoor applications to control household pests or by translocation from outdoor sources. Pesticides disperse according to their physical properties and other factors such as human activity, residential air exchange, temperature and humidity. A study was conducted in the U.S. EPA Indoor Air Quality test house to determine the spatial and temporal distribution of chlorpyrifos following a professional crack and crevice application in the kitchen. Following the application, measurements were made in the kitchen, den and master bedroom over 21-days. Airborne concentrations were collected using both polyurethane foam (PUF) and a XAD/PUF media. Transferable chlorpyrifos residues were determined using a press sampler and C18 extraction discs. Spatial distributions, application surface loadings, and redeposition were measured using 10 cm² deposition coupons. Sections were cut from existing carpet to determine the total extractable residues. Surface wipes were and vacuum dislodgeable residues were collected in the kitchen and carpeted den, respectively. Measured airborne concentrations were similar for both samplers, detected in all rooms sampled, reached maximal concentrations 24-hours post-application and steadily declined by day 21. Concentrations measured from deposition coupons suggest that airborne residues sorbed to deposition coupons in all rooms sampled. However, carpet sections, due to high background concentrations of chlorpyrifos, poorly resolve the contribution of the application to carpet residues. This work has been funded wholly or in part by the United States Environmental Protection Agency. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Presented Published

Wallace, L.A., Croghan, C., Howard-Reed, C., and Persily, A. PMHOME: A database of continuous particle measurements in an occupied house over a four-year period. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/031 (NTIS PB2002-106287).

6/30/2002

Contact: Lance A. Wallace

Abstract: Although considerable data exist on 24-hour integrated measurements of fine and coarse particles indoors, much less information is available on moment-to-moment variation for a full range of particle sizes including ultrafine particles. Also, information is limited on the relationships between air change rates, temperature, humidity, indoor-outdoor concentration ratios, indoor source strengths due to various activities such as cooking and cleaning, penetration factors, and deposition rates under realistic conditions. Therefore EPA and NIST have collaborated on a four-year (October 1, 1996 through Dec. 31, 2000) study of particle concentrations in an occupied townhouse. Target pollutants included ultrafine, fine, and coarse particles from 10 nm to 20 mm in diameter; black carbon (BC); and particle-bound polyaromatic hydrocarbons (PAH). Ancillary measurements included air change rates, wind velocity, temperature, and relative humidity. Measurements were made continuously and the final database (PMHOME) is on a 5-minute basis. PMHOME is available to researchers in Statistica or SAS format. Types of investigations that can be done using PMHOME include calculating the relative contribution of outdoor air particles to indoor air concentrations, effects of indoor sources such as cooking and candle burning, and relationships of air change rates to outdoor temperature and wind speed. Chemical monitoring of the environment is performed in the United States by Federal and State agencies, local governments, industries, organizations, and private individuals. The major reasons for monitoring are for compliance with laws and regulations, investigation of suspected environmental contamination, and general concerns for the protection of human health and the environment. An overview of the chemical monitoring performed by the above entities will be presented. The role of the U. S. EPA in environmental chemical monitoring will be discussed. This will include the Regional and Program Office responsibilities and activities and how the Office of Research and Development (ORD) is involved. General areas of current ORD research will be covered and examples will be given of current research projects involving passive sampling devices. This work has been funded wholly or in part by the United States Environmental Protection Agency and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Blancato, J.N., Power, F.W., Wilkes, C.R., Tsang, A.M., Hern, S.C., and Olin, S.S. Integrated probabilistic and deterministic modeling techniques in estimating exposure to water-borne contaminants: part 2 pharmacokinetic modeling. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/076 (NTIS PB2002-107513).

6/30/2002

Contact: Jerry N. Blancato

Abstract: The Total Exposure Model (TEM) uses deterministic and stochastic methods to estimate the exposure of a person performing daily activities of eating, drinking, showering, and bathing. There were 250 time histories generated, by subject with activities, for the three exposure routes, oral, dermal, and inhalation, and these were input to the physiologically based pharmacokinetic (PBPK) model, via ERDEM (Exposure Related Dose Estimating model). The chemicals modeled were trichloroethylene (TCE), trichloroacetic acid (TCA), and dichloroacetic acid (DCA). Time histories of concentrations and Areas Under the Curve (AUC) were determined for the liver, kidney, and venous blood. They were combined to determine the distribution at each time step and hence define the 5th, 50th, and the 95th percentiles. The important pathways and the basis for their predominance are shown. Thus highly variable exposures can be related to actual dose to various organs of the human body. The United States Environmental Protection Agency through its Office of Research and Development collaborated in the research described here and the Office of Water partially funded the work under Cooperative Agreement CX-822663-01. This work is being submitted for peer review and has not yet been approved for final publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Presented Published

Wilkes, C.R., Blancato, J.N., Hern, S.C., Power, F., and Olin, S.S. Integrated probabilistic and deterministic modeling techniques in estimating exposure to water-borne contaminants: part 1 exposure modeling. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/070 (NTIS PB2002-107518).

6/30/2002

Contact: Stephen C. Hern

Abstract: Exposure to contaminants originating in the domestic water supply is influenced by a number of factors, including human activities, water use behavior, and physical and chemical processes. The key role of human activities is very apparent in exposure related to volatile water-borne contaminants, since the release of a contaminant and resultant exposure is related to the activity of the exposed individual. Estimates of human exposure are often plagued by a poor understanding of many of the factors affecting the predictions. For example, existing activity pattern surveys do not contain integrated information about relevant water-using activities such as showers, and showering studies do not collect relevant information about the location, duration, and water temperature. Methods for integrating diverse data resources into a consistent modeling framework have been developed and implemented for prediction of exposure to water-borne contaminants. These methods are implemented in a computer model entitled the Total Exposure Model (TEM). TEM predicts the exposure and dose to an individual resulting from use of a contaminated water supply by modeling the fundamental physical and chemical processes that occur during interaction between the contaminated media (in this case water and air) and the exposed individual. An application of the model to estimate inhalation, dermal and ingestion exposure to several common waterborne contaminants to several population groups will be presented. The exposure study considers the expected exposure of a population group to water-borne trichloroethylene (TCE), dichloroacetic acid (DCA) and trichloroacetic acid (TCA). The distributions of exposures are estimated for several population groups to each compound as a function of route of exposure (inhalation, dermal and ingestion). The results are provided as inputs to a pharmacokinetic model, ERDEM (Exposure Related Dose Estimating Model) where target organ concentrations and doses are estimated across the population groups. This paper presents the results of the exposure modeling and analysis. A second, related paper will also be presented providing the methods and results of the pharmacokinetic modeling. This work has been funded wholly or in part by the United States Environmental Protection Agency and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Wilkes, C.R., Hern, S.C., and Mason, A.D. Analysis of household water use behavior for use as IAQ model parameters. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/072 (NTIS PB2002-107516).

6/30/2002

Contact: Stephen C. Hern

Abstract: Chemicals brought into the home through the domestic water supply, result in human exposure via the three principal routes: ingestion, inhalation, and dermal contact. Disinfection byproducts resulting from the treatment of municipal water supplies lead to the formation of a mixture of organic compounds ranging from high to low volatility. The inhalation route has been shown to be the most significant route of exposure for the more volatile chemicals. In assessing exposure to indoor air contaminants, understanding population water-use behavior for indoor water-use activities as a function of demographic characteristics is vital to realistic exposure estimates. Currently, there are few and limited studies that analyze household water-use behavior; the leading resources are summarized in the Exposure Factors Handbook (U.S. EPA, August 1997). In response to the need for more specific and usable population based water-use data to be used as inputs for exposure modeling, new data sources have been analyzed. Frequencies and durations of use of showers, baths, clothes washers, dishwashers, toilets and faucets are presented and compared for various demographic groups derived from analyses of the National Human Activities Pattern Survey (NHAPS) database, the Residential End Uses of Water Study (REUWS) database, the Residential Energy Consumption Survey (RECS) as well as from current literature and manufacturer information. Volumes and flowrates are also analyzed from REUWS for the various water uses. Distribution parameters for water use behaviors of various sub-population groups are identified for water uses to be used as inputs for modeling of exposure to water borne contaminants. The results from the database analyses will be presented in the form of fitted distributions for water-use durations for the various sub-population groups. A summary of frequency of use parameters for all water uses, and volume and flowrate characteristics of clothes washers and dishwasher appliances are also presented. This work has been funded wholly or in part by the United States Environmental Protection Agency and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Robertson, G.L., Lebowitz, M., Needham, L., O'Rourke, M.K., Rogan, S.R., Petty, J., and Huckins, J. Distribution of residential organochlorine pesticide residuals along the Arizona/Mexico Border. Presented at: Indoor Air 2002, Monterey, CA, June 30-July 5, 2002. EPA/600/A-02/071 (NTIS PB2002-107517).

6/30/2002

Contact: Gary L. Robertson

Abstract: The use of DDT has been banned for many years in the United States. Mexico began a 10-year phase out of DDT in 1997. DDT was banned in the U.S. primarily because of its environmental persistence. Thus, DDT is still found in the outdoor and indoor environment. We report the results from samples collected in 83 homes in Arizona along the Arizona/Mexico border. The media sampled included indoor air, floor dust, dermal wipes, and blood serum. 4,4'-DDT was detected in 62% of the floor dust samples, 19% of the indoor air samples, and 31% of the dermal wipes. This may be from spray residuals in older housing stock, recent use of chemicals obtained in Mexico, track-in from outdoor usage, or other sources. We report on the concentrations found, examine the distributions of occurrence of DDT analogs in the various media and discuss possible sources of these occurrences. This work has been funded wholly or in part by the United States Environmental Protection Agency and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.